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RESEARCH DEPARTMENT

# U.H.F. field trials 1962/63: laboratory tests carried out on prototype 625-line u.h.f. colour and monochrome receivers

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THE BRITISH BROADCASTING CORPORATION
ENGINEERING DIVISION

RESEARCH DEPARTMENT

# U.H.F. FIELD TRIALS 1962/63: LABORATORY TESTS CARRIED OUT ON PROTOTYPE 625-LINE U.H.F. COLOUR AND MONOCHROME RECEIVERS

Technological Report No. T-138

(1964/70)

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# U.H.F. FIELD TRIALS 1962/63: LABORATORY TESTS CARRIED OUT ON PROTOTYPE 625-LINE U.H.F. COLOUR AND MONOCHROME RECEIVERS

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# U.H.F. FIELD TRIALS 1962/63: LABORATORY TESTS CARRIED OUT ON PROTOTYPE 625-LINE U.H.F. COLOUR AND MONOCHROME RECEIVERS

## SUMMARY

The characteristics of nine prototype 625-line colour receivers and fourteen 625-line monochrome receivers were evaluated in connection with the 'home-viewing' tests that formed part of the U.H.F. Field Trials which took place during 1962/63. This investigation was undertaken jointly by the BBC Designs and Research Departments. In this report, the work carried out by Research Department is described in detail and discussed: certain of the Designs Department measurements are also discussed and a complete summary of all the measurements is given in one of the Appendices.

## 1. INTRODUCTION

During the 1962/63 Field Trials, an extensive 'home-viewing' experiment was conducted[1] in which prototype u.h.f. colour and monochrome domestic receivers were installed in selected viewers' homes. Samples of each type of receiver were subjected to a series of laboratory tests which are listed in Appendix I, and it will be seen that some of the tests were carried out by Designs Department, the remainder being performed by Research Department. This report is particularly concerned with the tests carried out by Research Department but, for completeness, a summary of the results of all the tests made on each receiver is given in Appendix II. In addition, a discussion of certain of the measurements performed by Designs Department is included in the text of this report. The descriptions of the experimental conditions and the discussion of the results of the tests carried out by Research Department are presented in the order in which they appear in Appendix II.

## 2. DETAILS OF THE TESTS

### 2.1. The response of monochrome and colour receivers to Channel (N + 10).

### 2.1.1. Frequency and amplitude relationships in a u.h.f. receiver.

Fig. 1 shows a block diagram of the vision-signal circuits of a typical u.h.f. television receiver, and Figs. 2(A)-(H) show the frequency and amplitude relationships occurring at the points indicated in Fig. 1 by corresponding letters.

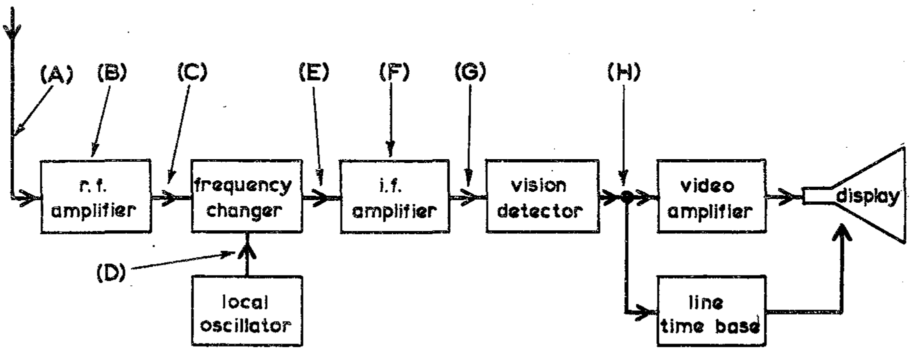

*Fig. 1 - Simplified block diagram of a u.h.f. television receiver*

The receiver is assumed to be correctly tuned to Channel N, the vision carrier of which has a frequency of $F_{(N)}$ Mc/s. The spacing between successive u.h.f. television channels is 8 Mc/s (Standard I) and the vision-carrier frequency of Channel (N + 10) is, therefore:

$$F_{(N+10)} = F_{(N)} + 80 \text{ where all frequencies are expressed in Mc/s.} \qquad (1)$$

For convenience, the amplitudes of the Channel N and Channel (N + 10) signals are assumed to be equal at the input to the receiver, as shown in Fig. 2(A), but after passing through the radio-frequency (r.f.) amplifier, whose amplitude/frequency characteristic is shown in Fig. 2(B), the Channel (N + 10) signal is attenuated relative to the Channel N signal, as shown in Fig. 2(C). These signals are applied to the frequency changer together with a signal from the local oscillator having a frequency $F_{(LO)}$, as shown in Fig. 2(D). The frequency of the vision carrier of the Channel N signal, at the intermediate frequency (i.f.), is $f_{(N)}$ where:

$$f_{(N)} = F_{(LO)} - F_{(N)} \qquad (2)$$

It should be noted that in this and subsequent equations an upper case letter '*F*' denotes an ultra-high frequency, while a lower case letter '*f*' denotes an intermediate or video frequency.

In receivers of British manufacture the intermediate frequency $f_{(N)}$ usually lies between 38 and 39·5 Mc/s; the intermediate frequency of the vision carrier of the Channel (N + 10) signal is given by:

$$f_{(N+10)} = F_{(N+10)} - F_{(LO)} \qquad (3)$$

and usually lies between 42 and 40·5 Mc/s. The intermediate-frequency relationships of the Channel N and Channel (N + 10) signals are shown in Fig. 2(E). The amplitude/frequency characteristic of the i.f. amplifier, shown in Fig. 2(F), further discriminates against the Channel (N + 10) signal before the signals reach the vision detector; their spectrum is shown in Fig. 2(G). The output of the vision detector shown in Fig. 2(H), contains an interference component having a frequency:

$$\begin{aligned} f_{(O)} &= f_{(N+10)} - f_{(N)} \\ &= 2\left[(F_{(N)} + 40) - F_{(LO)}\right] \qquad (4) \end{aligned}$$

from (1), (2) and (3).

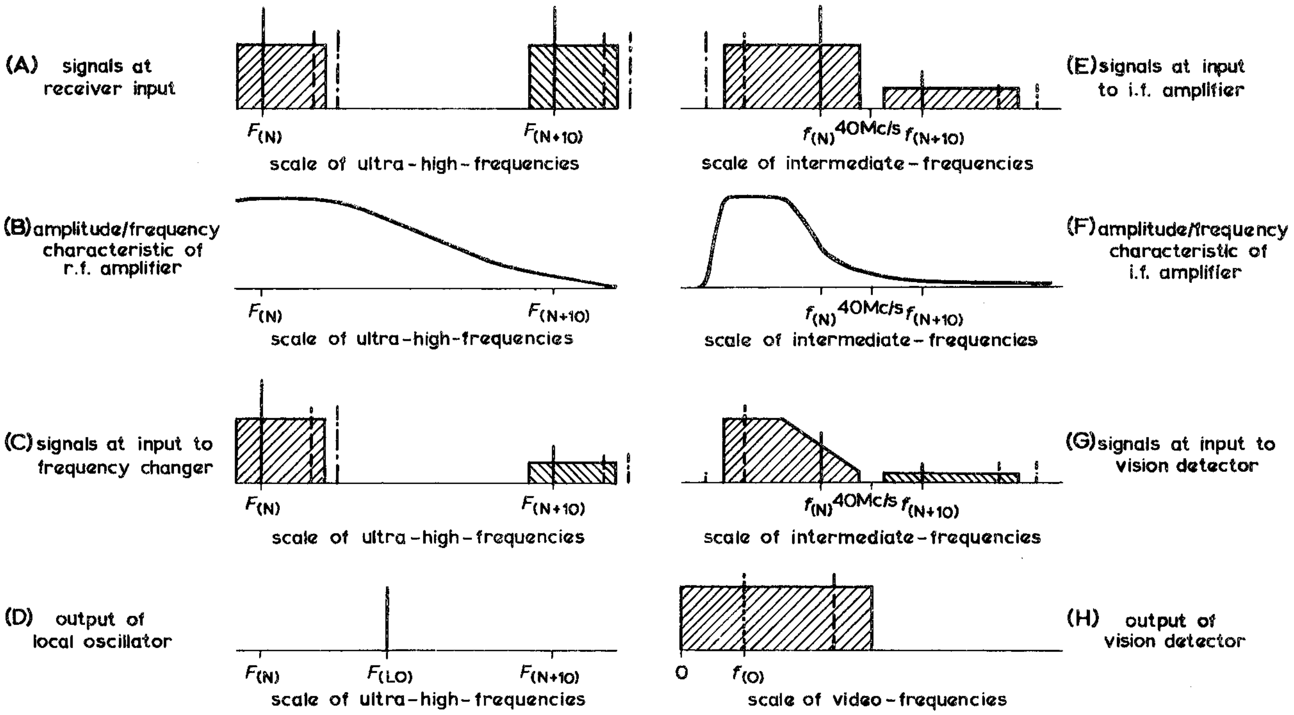
(A) signals at receiver input
$F_{(N)}$
$F_{(N+10)}$
scale of ultra-high-frequencies
(E) signals at input to i.f. amplifier
$f_{(N)}$ 40Mc/s $f_{(N+10)}$
scale of intermediate-frequencies
(B) amplitude/frequency characteristic of r.f. amplifier
$F_{(N)}$
$F_{(N+10)}$
scale of ultra-high-frequencies
(F) amplitude/frequency characteristic of i.f. amplifier
$f_{(N)}$ 40Mc/s $f_{(N+10)}$
scale of intermediate-frequencies
(C) signals at input to frequency changer
$F_{(N)}$
$F_{(N+10)}$
scale of ultra-high-frequencies
(G) signals at input to vision detector
$f_{(N)}$ 40Mc/s $f_{(N+10)}$
scale of intermediate-frequencies
(D) output of local oscillator
$F_{(N)}$
$F_{(LO)}$
$F_{(N+10)}$
scale of ultra-high-frequencies
(H) output of vision detector
0
$f_{(0)}$
scale of video-frequencies

*Fig. 2 - Frequency and amplitude relationships in a u.h.f. (Standard I) television receiver*

| KEY | Vision carrier | Chrominance subcarrier | Sound carrier | Interference component | Cross-hatching indicates vision sidebands |
|---|---|---|---|---|---|

$F_{(N)}$ - vision-carrier frequency of Channel N

$F_{(N+10)}$ - vision-carrier frequency of Channel (N + 10)

$F_{(LO)}$ - local-oscillator frequency

$f_{(N)}$ - intermediate frequency of vision-carrier frequency of Channel N

$f_{(N+10)}$ - intermediate frequency of vision-carrier frequency of Channel (N + 10)

$f_{(0)}$ - frequency of interference component in vision detector output

This component may give rise to an interference pattern on the displayed picture.[2] The ratio of the amplitudes of the Channel N and Channel (N + 10) signals at the input to the receiver which causes this interference pattern to become visible depends on three factors:

(a) The discrimination of the r.f. amplifier against the Channel (N + 10) signal (c.f. Fig. 2(B)).

(b) The discrimination of the i.f. amplifier against the Channel (N + 10) intermediate-frequency signal (c.f. Fig. 2(F)).

(c) The value of $f_{(0)}$; this governs the relative visibility of the interference pattern, high values of $f_{(0)}$ giving rise to finer and therefore less visible patterns than low values of $f_{(0)}$ (as described in Reference 2). In addition, the value of $f_{(0)}$ is clearly an important consideration in determining factor (b) above.

When recording the measurements of image rejection, the combined effect of all these factors has been stated and, in addition, factor (a) has been separately measured and stated.

### 2.1.2. The equipment arrangement

Fig. 3 shows the equipment arrangement for the measurement of the response to Channel (N + 10). The wanted, Channel N, signal was derived from a signal generator, the output from which could be modulated with a video signal obtained from a flying-spot scanner. The interfering signal (Channel (N + 10)) was derived from another signal generator; for the sake of simplicity, this generator gave a continuous-wave (c.w.) output. The outputs of each signal generator were variable in frequency over the whole range of Bands IV and V, and could be controlled in amplitude to within ± 0·5 dB of the nominal value by means of calibrated attenuators*. These outputs were combined in a resistive network and supplied through a coaxial switch to either the receiver under test or a check receiver. The output of the vision detector of the check receiver was observed on a d.c. connected oscilloscope; the magnitudes of the signals from the two signal-generators and the modulation depth of the wanted signal could thus be directly observed. Equal lengths of cable (shown as heavy lines in Fig. 3) were used from the switch to each receiver to avoid errors due to differences in attenuation in these two paths.

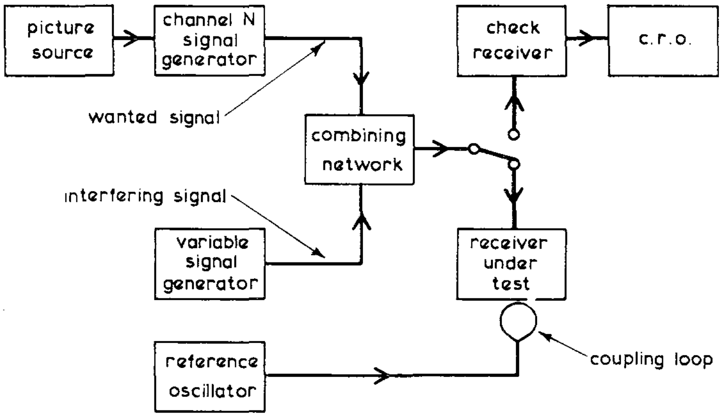

*Fig. 3 - Block diagram of equipment arrangement for measurement of image rejection*

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* Normally the magnitude of the Channel N signal was set to have a vision (tip of synchronizing pulses) e.m.f. of 2 mV r.m.s. In some receivers, however, a greater magnitude was used in order to ensure that the picture display was free of receiver noise.

The frequency separation between the wanted and interfering signals was defined (by a method explained in Section 2.1.3. below) relative to the frequency of reference oscillator. This oscillator took the form of a frequency synthesizer whose output was continuously variable in frequency while retaining a stability of better than one part in ten million. The output of this oscillator was injected into the i.f. amplifier of the receiver under test, using a single-turn coupling loop placed adjacent to the receiver.

### 2.1.3. Method of measurement of Channel (N + 10) response

A measurement of the response to Channel (N + 10) requires that the difference in frequency between the outputs of the two generators be accurately adjusted to be 80 Mc/s. This can be accomplished by measuring first, the intermediate frequency of the vision-carrier of the wanted, Channel N, signal (i.e. $f_{(N)}$) and then measuring the intermediate frequency of the interfering c.w. signal representing the Channel (N + 10) signal (i.e. $f_{(N + 10)}$), the frequency of the local oscillator of the receiver ($F_{(LO)}$) remaining constant during the whole of this procedure. It can be seen from Equations (2) and (3) that:

$$f_{(N)} + f_{(N + 10)} = F_{(N + 10)} - F_{(N)} \qquad (5)$$

From Equation (1) it can be seen that the frequencies of the two signal-generator outputs are correctly adjusted when:

$$f_{(N)} + f_{(N + 10)} = 80 \text{ Mc/s} \qquad (6)$$

The values of $f_{(N)}$ and $f_{(N + 10)}$ can be defined by injecting a signal of the appropriate frequency from the reference oscillator into the i.f. amplifier of the receiver. This gives rise to an interference pattern on the displayed picture[3] and the values of $f_{(N)}$ and $f_{(N + 10)}$ can then be adjusted until an indication of 'zero beat' between each of these signals and the reference oscillator is obtained.

In practice, the reference oscillator was first adjusted so that its output frequency had the required value of $f_{(N)}$; the wanted signal $F_{(N)}$ was applied to the receiver and the local oscillator of the receiver was adjusted by operating the tuning control until the correct value of $f_{(N)}$ was obtained.* The wanted signal was then removed and the interfering signal substituted. The reference oscillator was re-adjusted so that its output frequency was the required value for $f_{(N + 10)}$, in accordance with Equation (6), and the frequency of the interfering signal ($F_{(N + 10)}$) was then adjusted until the correct value of($f_{(N + 10)}$) was obtained. The wanted signal was then re-applied to the receiver and the reference-oscillator signal removed. The ratio of the magnitudes of the interfering and wanted signals was adjusted until the interference pattern produced by the component of frequency $f_{(0)}$, Equation (4), was just perceptible when the picture was viewed from a distance of four times the picture height. During this adjustment the frequency of the interfering signal was adjusted over a range of ± 8 Kc/s in order to ensure that an interference pattern of

* The nominal intermediate frequency, quoted by the manufacturer of the receiver, was usually taken as the correct value. It was sometimes found, however, that when a receiver was used to receive a broadcast transmission, satisfactory performance on both vision and sound signals could only be achieved when the intermediate frequency differed from this nominal value. In these cases the tests were carried out with the intermediate frequency adjusted to give the best reception of vision and sound signals.

maximum visibility was produced.[2] The ratio between the wanted and interfering signals obtained in this way was then corrected to allow for the fact that, in practice, the Channel (N + 10) signal would be another television transmission; this correction took the form of an increase of 4 dB in the level of the Channel (N + 10) signal.[4]

It can be seen from Fig. 2(E) that, in receivers of British manufacture having vision-carrier intermediate frequencies lower than 49 Mc/s, no interference is likely to be produced by the sound carrier of the Channel (N + 10) signal. However, u.h.f. receivers manufactured in the U.S. have a vision-carrier intermediate frequency of approximately 45 Mc/s. In this case the frequency relationships between Standard I Channel N and Channel (N + 10) signals at i.f. are as shown in Fig. 4, where it can be seen that the sound carrier of the Channel (N + 10) signal falls in the i.f. passband of the receiver. The interference component produced by the Channel (N + 10) sound carrier will have a relatively high frequency and will produce, on a monochrome receiver, a fine and therefore relatively unobjectionable pattern. For colour reception, however, this interference component may fall very near to the colour subcarrier and thus produce a very objectionable pattern. It may be noted that in the NTSC colour receiver of American manufacture that was modified for use during the present series of Field Trials (see Appendix II) the vision-carrier i.f. was modified so as to conform with the standard adopted in this country, whereas in the case of the monochrome receivers of American manufacture, this modification was not considered necessary.

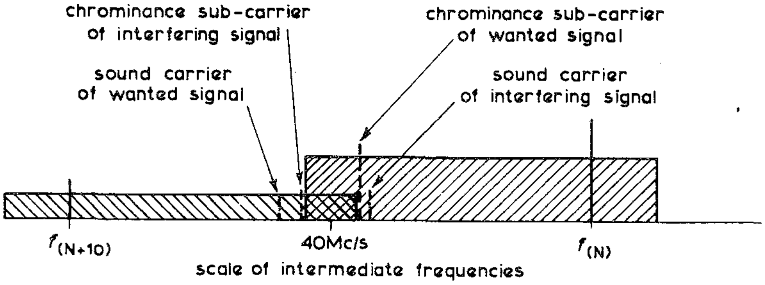
chrominance sub-carrier of interfering signal
chrominance sub-carrier of wanted signal
sound carrier of wanted signal
sound carrier of interfering signal
$f_{(N+10)}$
40Mc/s
$f_{(N)}$
scale of intermediate frequencies

*Fig. 4 - Frequency relationships in a u.h.f. (Standard I) television receiver using the American intermediate-frequency standards*

KEY

$f_{(N)}$ - intermediate frequency of vision-carrier frequency of Channel N

$f_{(N + 10)}$ - intermediate frequency of vision-carrier frequency of Channel (N + 10)

### 2.1.4. The measurement of the contribution of the radio-frequency stages to the attenuation of the Channel (N + 10) signal

The equipment arrangement shown in Fig. 3 was used to measure the discrimination of the radio-frequency amplifier in the receiver under test against the Channel (N + 10) signal; see Fig. 2(B). For this measurement the frequency of the interfering signal was first adjusted to be very nearly equal to that of the wanted signal. The receiver under test then displayed a high-visibility interference pattern. The magnitude of the interfering signal was then reduced until this pattern was only just perceptible; this magnitude, $A_1$, was noted. The magnitude of the interfering signal was then increased considerably and the frequency was then increased, by approximately 80 Mc/s, until the intermediate frequencies of the wanted vision-carrier and the interfering signal ($f_{(N)}$ and $f_{(N + 10)}$ in Equations 2 and 3 of Section 2.1.1.) were very nearly equal. The receiver then again displayed a high-visibility interference pattern, and the magnitude of the interfering signal required to render this pattern only just perceptible, $A_2$, was noted. The attenuation of the r.f. amplifier in the receiver to Channel (N + 10) signals was then given by the ratio $\frac{A_1}{A_2}$.

### 2.2. The response to unwanted radio-frequency signals

The measurement of the response to unwanted r.f. signals other than those occurring in the region of the image frequency (i.e. the measurement of spurious responses) was carried out using the equipment arrangement shown in Fig. 3. The frequency of the interfering signal was swept over the whole range of Bands IV and V and any appearance of an interference pattern on the display of the receiver was noted. The ratio of the magnitudes of the wanted and interfering signals required to reduce the visibility of the pattern so as to be only just perceptible (with the frequency of the interfering signal adjusted to give a pattern of maximum visibility) was noted in each case, together with the approximate frequency of the interfering signal. In general, spurious responses which became visible only when the magnitude of the interfering signal exceeded that of the wanted signal by more than 15 dB were not recorded on the test report. This restriction was, however, sometimes waived in cases of special interest, for example, in a comparison of several receivers produced by one manufacturer. In all cases, the appropriate correction was applied (see Section 2.1.3.) to allow for the fact that the interfering signal used in the measurements was unmodulated.

### 2.3. Local-oscillator parameters

The effect of a given change of the local-oscillator frequency is independent of the band in which the transmission lies, and a more stringent requirement on percentage frequency tolerance is therefore encountered in Bands IV and V than in the present transmissions in Bands I and III. The total frequency drift of the local oscillator, after switching on the receiver, was measured together with the time elapsed before the frequency reached a stable value. The technique for carrying out this measurement has been described elsewhere.[3] Briefly, a signal from the reference oscillator was injected into the i.f. amplifier of the receiver as described in Section 2.1.3; the resulting interference pattern underwent a cyclic change in structure, appearing as a rotary movement of the pattern stripes, as the frequency of the local-oscillator (and therefore the vision-carrier intermediate frequency, $f_{(N)}$) drifted as the receiver warmed up. The time intervals between the successive occasions when the pattern consisted of a series of vertical stripes were noted. Each interval represented the time taken for the frequency of the local-oscillator to change by a value equal to the line-scan frequency; thus a curve relating change in local-oscillator frequency with time could be plotted.

In the measurements (see Appendix II) of the time taken for the frequency of the local-oscillator to reach a stable value it was assumed that stability had been reached when the frequency was within ± 150 Kc/s of the final value. This criterion was based on the fact that, owing to the shift of the vision-carrier intermediate frequency relative to the vestigial-sideband amplitude/frequency response of the i.f. amplifier, a change in local-oscillator frequency of 150 Kc/s causes a change of about 1 dB in the output of the vision detector. In practice, this change is very substantially reduced by the action of the automatic-gain-control (a.g.c.) circuits and in the majority of cases, a negligible alteration of picture brightness takes place.

An estimate of the local-oscillator radiation was made by measuring the magnitude of the signal, due to the local-oscillator, appearing across the u.h.f. input socket of the receiver when this socket was terminated in 75 ohms. A substitute method was used for this measurement, the u.h.f. aerial socket of the receiver under test and a standard signal generator being connected in turn to a measuring receiver (see Section 2.1.2.). The magnitude of the local-oscillator signal was expressed in terms of the potential difference (p.d.) appearing across the termination.

### 2.4. Receiver tuning

The arrangements for tuning differed widely between different makes of receiver and an assessment was therefore made of the ease with which non-technical viewers would be able to make this adjustment. For this purpose, the receiver was supplied with the appropriate colour or monochrome signal from the Crystal Palace u.h.f. transmissions at a level sufficiently high to give a displayed picture virtually free of receiver noise.* The ease of adjustment was assessed in terms of the subjective scale shown in Table 1.

*TABLE 1*

*Scale for assessment of ease of tuning*

| DESCRIPTION | SCORE |
|---|---|
| Excellent | 1 |
| Good | 2 |
| Fairly good | 3 |
| Rather poor | 4 |
| Poor | 5 |
| Very poor | 6 |

The amount by which the receiver could be de-tuned until the received signal (picture or sound) became only just acceptable was also measured. As in the assessment of ease of tuning described above, the degree of signal degradation which constituted unacceptability was judged in terms applicable to domestic viewing.** When the receiver had been adjusted to give this quality of reception, the vision-carrier intermediate frequency ($f_{(N)}$, Equation (2)) was measured using the technique described in Section 2.1.3.; the upper and lower frequency limits measured in this way were recorded on the test report as deviations from the nominal frequency of $f_{(N)}$.

### 2.5. Automatic gain control

The effectiveness of the a.g.c. action of the receiver under test was measured by noting the increase or decrease of input signal magnitude, relative to the standard magnitude defined in Section 2.1.2.,* required to produce an increase or decrease of 1 dB in the output of the vision detector. In some receivers with particularly good a.g.c. action, however, the upper limit was set by distortion of the detector output causing a 'crushing' of picture black, while the lower limit was set by the appearance of excessive receiver noise.

---

* See footnote on page 4

** In the case of receivers fitted with tuning indicators, the tuning was adjusted until an 'off-tune' condition was obviously indicated.

### 2.6. Positional and brightness hum

Positional hum can appear as a periodic side-to-side displacement of the whole or part of the scanning raster and as a periodic bunching and separation of the scanning lines: these effects may appear separately or together, and may vary in amplitude over the picture area. Brightness hum takes the form of one (or two) light and one (or two) dark horizontal bands superimposed on the displayed picture. Both effects can be produced by mains-frequency components (or twice mains-frequency components, if full-wave rectification is used in the receiver) present in the supplies to various receiver circuits; in addition, both forms of hum can arise due to the high heater-cathode potentials that are unavoidable when the valve heaters are connected in series. Further, positional hum may be caused by magnetic leakage fields from transformers or chokes.

The effects move through the picture at the difference between the supply-mains and field-scan frequencies, and their visibilities therefore depend[5] on the frequency of the supply-mains when the television system is asynchronous (i.e. when the field-scan frequency is constant and independent of the supply-mains frequency) as is the case with 625-line u.h.f. transmissions. In order to be able to assess the visibility of the effects under the worst conditions likely to be encountered in practice, the receiver under test was supplied with power from a variable-frequency generator and the supply and field-scan frequencies were arranged to differ by 0·2 c/s; this difference frequency is not likely to occur in practice for more than 1·5% of the time.[6] An additional advantage of this form of test is that hum effects produced in the receiver are distinguishable from any that might have been produced in the picture generating and transmission equipment.

### 2.7. V.H.F. performance

In the case of 'dual-standard' receivers which were designed to receive the 405-line v.h.f. services in addition to the 625-line u.h.f. transmission, the performance when tuned to Channel 1 (Band I) and Channel 9 (Band III) was checked; no detailed measurements, however, were made.

## 3. DISCUSSION OF TEST RESULTS

### 3.1. The response to Channel (N + 10)

#### 3.1.1. Signal-magnitude ratio required for just perceptible interference

The ratio of the magnitude of the wanted (Channel N) signal to that of the interfering (Channel (N + 10)) signal required to produce just perceptible interference under the conditions described in Section 2.1.3. is shown, for each receiver, in the test reports included in Appendix II. The average ratios for channels situated in the low, middle and upper frequency ranges* of Bands IV and V are shown in Table 2 for the cases in which this ratio was measurable. The results obtained from the two receivers of U.S. manufacture (monochrome receivers 11 and 12, Appendix II) are discussed separately. Statistical analysis shows that the differences between the ratios for the three frequency ranges are not significant; the average ratio for all British receivers was less than − 30 dB.

---

* See footnote, page 4

### *TABLE 2*

*Average response to Channel (N + 10) for some receivers of British manufacture*

| FREQUENCY RANGE | LOW | MIDDLE | HIGH |
|---|---|---|---|
| Average response to Channel (N + 10) dB | −26 | −27 | −30 |

It can be seen (Section 2.1.1.) that the discrimination against the Channel (N + 10) signal will depend on the vision-carrier intermediate frequency of the Channel N signal ($f_{(N)}$ in Equation (2)). If $f_{(N)}$ decreases $F_{(LO)}$ must decrease for a given value of $F_{(N)}$ and $f_{(O)}$ (Equation (4)) must therefore increase; the i.f. amplifier will therefore discriminate more effectively against the Channel (N + 10) signal and, in addition, the interference pattern will be finer and therefore reduced in visibility (factors (b) and (c); *page 4*). This relationship is borne out by the results of the tests; the receivers in which the frequency of the vision-carrier intermediate frequency was 39·0 Mc/s or less could, in general, tolerate a greater magnitude of interfering, Channel (N + 10), signal than the receivers in which the vision-carrier intermediate frequency was higher than 39·0 Mc/s; this increase in tolerance was greater than 12 dB.

It should be noted that a reduction of the frequency range of the Nyquist flank in the receiver will decrease its sensitivity to Channel (N + 10) interference: such a reduction would, however, lead to an increase in the effects of quadrature distortion and would therefore be undesirable.

In the case of the two monochrome receivers of American manufacture the vision-carrier had an intermediate frequency of some 45 Mc/s and the sound-carrier of the Channel (N + 10) signal fell in the i.f. passband of the receiver as described in Section 2.1.3. (*page 5*). These receivers would not therefore be expected to show as high a discrimination against the Channel (N + 10) signal as the receivers of British manufacture; in fact the average ratio of the magnitude of the Channel N signal to that of the Channel (N + 10) signal required for just perceptible interference was 3 dB as compared with − 28 dB for the British receivers. It should, however, be noted that 17 dB of this difference appears to be due to the less effective radio-frequency discrimination against the Channel (N + 10) signal in the case of the U.S. receivers; this point is discussed in the following section.

---

* 'Low' in this context implies the lower channels (numerically) of Band IV, 'middle' the upper channels of Band IV or the lower channels of Band V, and 'upper' the upper channels of Band V

### 3.1.2. The attenuation of the Channel (N + 10) signal by the radio-frequency stages

The mean discrimination of the radio-frequency stages of all the receivers tested is shown in Table 3. The differences between the values for the three frequency ranges are not statistically significant; the average value over all three frequency ranges is therefore 53 dB and the standard deviation is ± 8 dB.

*TABLE 3*

*Average r.f. attenuation of Channel (N + 10) signal for all receivers tested*

| FREQUENCY RANGE | LOW | MIDDLE | HIGH |
|---|---|---|---|
| Average r.f. attenuation of Channel (N + 10) signal (dB) | 53 | 52 | 54 |

The mean value of the r.f. discrimination of the monochrome receivers of U.S. manufacture was some 17 dB lower than the average value of all receivers. This difference appeared to be responsible for about half of the increased sensitivity to the Channel (N + 10) signal mentioned in Section 3.1.1. It is not certain, however, whether this performance is typical of U.S. receivers.

Some receivers were fitted with u.h.f. tuners having an extra r.f. tuned circuit (these have been termed '4-gang' tuners); the mean r.f. discrimination of these receivers was some 7 dB better than the average figure.

## 3.2. The response to unwanted radio-frequency signals

Only one monochrome and three colour receivers showed any significant response to signals other than those in either the wanted or the image channel; the three colour receivers which suffered from this defect were obtained from the same manufacturer. The cause of these responses is not certain.

## 3.3. Local-oscillator parameters

### 3.3.1. Frequency drift

The majority of the receivers exhibited local-oscillator frequency drifts of less than 400 Kc/s, only four showing drifts above this value. Excluding these four receivers, the mean total values of this drift were 215 Kc/s (with a standard deviation of ± 96 Kc/s) for the 15 receivers not provided with automatic frequency control (a.f.c.) and 77 Kc/s (with a standard deviation of ± 60 Kc/s) in the case of the four (colour) receivers in which an a.f.c. circuit was incorporated. For those receivers not fitted with a.f.c. two minutes elapsed, on average, before the oscillator frequency was within 150 Kc/s of the final value (see Appendix II); however, the oscillators of five of these receivers exhibited total drifts of 150 Kc/s or less and thus no 'warm-up' time was necessary. The receivers of U.S. manufacture were particularly good in this respect.

Taking into account the four receivers that exhibited local-oscillator frequency drifts of over 400 Kc/s it is evident that, in a few receivers, very considerable drift may occur. However, in the majority of receivers, this drift is within reasonable limits and may be expected to improve still further in the future.

### 3.3.2. Potential difference across the u.h.f. input socket due to the local-oscillator

Table 4 shows the mean local-oscillator potential difference appearing across the terminated u.h.f. input for each frequency range tested. The differences between the values for the three frequency ranges are not statistically significant; the average value over all three frequency ranges is 51 dB relative to 1 μV with a standard deviation of ± 9 dB. This value is within the limit of local-oscillator radiation recommended by BREMA at least as far as re-radiation of the local-oscillator signal from the receiving aerial is concerned.

The mean p.d. value from the two receivers of U.S. manufacture was 20 dB greater than the average taken over all the receivers: however, it is again not known whether this performance is typical.

*TABLE 4*

*Average local-oscillator p.d. at terminated input socket for all receivers tested*

| FREQUENCY RANGE | LOW | MIDDLE | HIGH |
|---|---|---|---|
| Local-oscillator p.d. at u.h.f. input socket (dB relative 1 μV) | 53 | 48 | 51 |

In the case of the receivers fitted with 4-gang tuners, the mean p.d. value was 5 dB lower than the average figure. This is consistent with the improvement of 7 dB, obtained with these tuners, in the discrimination against the Channel (N + 10) signal (Section 3.1.2.); the difference between the frequency of the wanted signal and that of the local oscillator is less than 40 Mc/s.

## 3.4. Receiver tuning

The average assessment of ease of tuning and the tuning range (i.e. the frequency range over which the vision-carrier intermediate frequency ($f_{(N)}$) of each receiver could be adjusted while preserving an acceptable picture) are shown for monochrome and colour receivers in Table 5.

*TABLE 5*

*Tuning parameters*

| TYPE OF RECEIVER | EASE OF TUNING | | TUNING RANGE (MC/S) | |
|---|---|---|---|---|
| | MEAN GRADE | STANDARD DEVIATION | MEAN RANGE | STANDARD DEVIATION |
| Monochrome (no a.f.c. or tuning indicator) | 3•4 | 1•3 | 1•8 | 0•8 |
| Colour (no a.f.c. or tuning indicator) | 3•8 | 1•0 | 1•0 | 0•3 |
| Colour (with a.f.c. and/or tuning indicator) | 2•4 | 0•9 | 0•22 | 0•19 |

The ease of tuning assessments are given in terms of the scale shown in Table 1 (*page 8*). It can be seen that the provision of automatic frequency control and/or a tuning indicator markedly improves the ease with which a colour receiver may be tuned. It may be concluded that the tuning of monochrome receivers would be made easier to the same extent if they were provided with similar facilities; the ease of tuning assessment would then correspond to grade 2 ('Good') in Table 1. The tuning range of the monochrome receivers was not distributed symmetrically about the nominal vision-carrier intermediate frequency. In general, an increase in frequency of only 0•1 Mc/s could be tolerated; further increase caused very pronounced 'sound-on-vision' effects to become apparent. On the other hand, a decrease in frequency of the i.f. vision-carrier of 1•7 Mc/s could, on the average, be tolerated; in this case the limiting factor was the extreme 'softness' of the picture, often accompanied by the disappearance of the sound signal. It is worth noting that when receiving a signal of low field strength, the subjective appearance of the receiver noise may be made considerably less annoying by tuning the receiver in this way; by the same means the subcarrier of a colour transmission can be reduced in visibility. It is therefore likely that monochrome receivers will in general be tuned so that their vision-carrier intermediate frequencies are lower than the nominal value. This is unfortunate in view of the advice given to the receiver industry that, in order to prevent interference from the local-oscillator of a receiver tuned to Channel N occurring in a transmission in Channel (N + 4), 'it is essential that steps should be taken to prevent viewers using their receivers mis-tuned in a downwards direction by more than about 1•4 Mc/s'.

In the case of one receiver of U.S. manufacture (monochrome receiver 11) pre-set tuning was used and in this case the ease of tuning was assessed as grade 1 ('Excellent'). It might be concluded that if pre-set tuning were to be universally adopted, with the tuning adjustment carried out only during the manufacture or maintenance of the receiver, the tuning range would be very much less than the present value for monochrome receivers. Although this conclusion might be correct on a short-term basis it is not certain whether this small tuning range would be maintained throughout the whole of the useful life of a receiver. The ageing of components and the mechanical wear of the tuning mechanism might over a long period of time cause a drift in the tuning which might not, however, affect the picture quality sufficiently to warrant the trouble and expense involved in having the tuning re-adjusted. In this case the use of pre-set tuning would not help in reducing the tuning range below the values discussed in the previous paragraph.

Only two SECAM receivers and one PAL receiver were tested, all the other colour receivers being designed for the NTSC system. It is, therefore, difficult to be certain whether the ease of tuning was affected by the choice of colour system.

### 3.5. Automatic gain control

Measurements on the reception of two co-sited u.h.f. transmissions separated in vision-carrier frequency by 80 Mc/s (10 channels) have shown[8] that the vision field strengths of the two signals are not likely to differ by more than 10 dB at 98% of the receiving sites. The receiver a.g.c. should be capable of compensating this difference so that the contrast control does not require adjustment after changing channels. In addition, fading effects may sometimes give rise to a 5 dB variation[9] of vision field strength and the a.g.c. should be capable of eliminating the effects of this variation from the displayed picture. An a.g.c. range of 15 dB, therefore, would seem a reasonable performance for a u.h.f. television receiver. Of the receivers tested, only four showed a.g.c. ranges less than this value, and twelve of the twenty-three receivers showed a.g.c. ranges in excess of 50 dB: it, therefore, seems that although most u.h.f. receivers exhibit a satisfactory a.g.c. performance, a few may be markedly poor in this respect.

### 3.6. Positional and brightness hum

Assessments of the effects of positional and brightness hum were made with eight monochrome receivers (Nos. 6-14 in Appendix II) and with all the colour receivers. Brightness hum was not visible on eleven of the receivers and was only just perceptible on a further two receivers. Positional hum was somewhat more apparent, being absent on only three receivers and just perceptible on a further four receivers. It must be remembered that these tests were carried out with a difference of 0·2 c/s between the frequency of the supply mains and that of the field-scan. For most of the time, the frequency difference is much less than 0·2 c/s and the hum effects are considerably reduced in visibility; in general, therefore, the performance of most of the receivers may be regarded as satisfactory in this respect.

### 3.7. Noise factor

The measurement of the noise factor and the assessment of the minimum signal input required for acceptable receiver operation was carried out by Designs Department. The noise factor measurements were made at three frequencies covering the low, middle and upper frequency ranges of Bands IV and V* and the results are summarized in Table 6.

* See footnote on page 10

### *TABLE 6*

*Average noise factors*

| FREQUENCY RANGE | | LOW | MIDDLE | HIGH |
|---|---|---|---|---|
| Noise factor (dB) | Mean value | 14•8 | 15•4 | 16•5 |
| | Standard deviation | 2•3 | 2•8 | 3•2 |

The differences between the values for the three frequency ranges are statistically significant and show that the noise factor increases with increase of frequency. It may be noted that all the receivers under test were fitted with u.h.f. tuners employing valves and that the noise factors of tuners incorporating transistors are likely to be lower.

The assessments of the minimum signal inputs required for acceptable receiver operation that are shown in Appendix II are average values obtained by combining the results obtained from five observers. These observations were made in the 'middle' frequency range. The minimum signal level should be proportional to the receiver noise factor if the failure of the receiver to produce acceptable picture and sound is determined solely by receiver noise: however, other receiver parameters such as the inherent sensitivity and the behaviour of the synchronising circuits may modify this relationship. In Fig. 5 these minimum usable signal levels are shown plotted as a function of the receiver noise factor. Curve (a) in Fig. 5 is the line of closest fit to the points that correspond to the monochrome receivers, assuming that a proportional relation between minimum usable signal and noise factor is observed. Curve (b) is the corresponding line of closest fit to the points obtained from measurements on the colour receivers. Curve (c) has been derived from mobile laboratory measurements of monochrome u.h.f. reception[1] by again assuming a proportional relationship between minimum usable signal and noise factor. The mobile laboratory results were expressed in terms of field strength

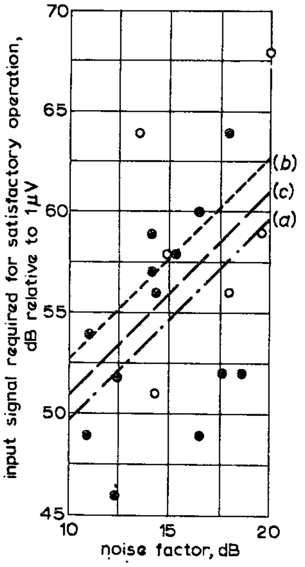

*Fig. 5 - The relation between minimum input signal and noise factor*

● Experimental results for monochrome receivers
○ Experimental results for colour receivers

KEY
—·— (a) Line of closest fit for monochrome receiver results
----- (b) Line of closest fit for colour receiver results
— — (c) Mobile laboratory measurement of monochrome u.h.f. reception

values, and in drawing curve (c) the assumptions have been made that the gain of the receiving aerial, relative to a dipole, was 14 dB and that the feeder loss was 3 dB. The scatter of the measurements obtained from the domestic receivers (curves (a) and (b)) is so great that the differences between these three curves have no statistical significance. It is, therefore, not possible to deduce from the domestic receiver measurements whether there is any significant difference between the minimum signals required for acceptable operation of a monochrome and a colour domestic receiver, or whether any significant difference exists between the measurements made using domestic monochrome receivers and the mobile laboratory measurements of monochrome u.h.f. reception.

## 4. CONCLUSIONS

A total of fourteen monochrome and nine colour receivers were tested by the BBC Designs and Research Departments; of these, one colour and two monochrome receivers were of U.S. manufacture, the remainder being of British manufacture. The performance of the British monochrome receivers was in general satisfactory. They were insensitive to unwanted signals (in particular the Channel (N + 10) signal), and the frequency drift of the local-oscillator and the amount of re-radiation of this signal by the receiving aerial were within acceptable limits; the effects produced by mains 'hum' were also small. However, four of the receivers had inadequate automatic gain control, and many of the receivers required considerable skill in adjustment of the tuning in order to obtain a satisfactory picture. The U.S. monochrome receivers were considerably more sensitive to the Channel (N + 10) signal, partly because of the choice of a higher intermediate frequency for the vision-carrier; radiation of the local-oscillator signal by the receiving aerial was also considerably greater in these receivers. On the other hand, the tuning of one of these receivers, which was provided with pre-set tuning facilities, was particularly easy. It is, however, not possible to draw any general conclusions about American receivers because of the very small number that were tested.

In the case of the colour receivers the provision of tuning indicators or automatic-frequency-control circuits improved the ease of tuning very markedly. The tuning of monochrome receivers would be greatly aided by the provision of similar facilities.

The somewhat high average value of noise factor shown by the receivers under test is expected to improve when 'transistorised' u.h.f. tuners become available.

All the monochrome receivers which were designed to accept either 405-line v.h.f. or 625-line u.h.f. transmissions gave satisfactory performance on the v.h.f. channels.

## 5. ACKNOWLEDGMENTS

The tests were carried out by Messrs. R.E. Haywood, J.D. Robinson and D.J. Walker of Designs Department, and by Messrs. A.F. Blake, J.D. Last and A.L. Wells of Research Department. The author would also like to express his thanks to Mr. J.G. Spencer of Research Department for helpful discussions during the preparation of this report.

## 6. REFERENCES

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9. 'Time Variations of V.H.F. and U.H.F. Signals at Short Distances'. Research Department Technological Report in course of preparation.

# *APPENDIX I*

## *Schedule of Receiver Tests*

### 1. Tests carried out by Designs Department

1.1. A subjective assessment of the beat between the sound and chrominance carriers which may be observed as an unwanted pattern on the screen of a monochrome or colour receiver when tuned to a colour emission.

1.2. The subjective assessment and measurement of the ranges of the ratios of chrominance-to-luminance and sound-to-luminance over which satisfactory monochrome and colour receiver operation is obtained.

1.3. The objective measurement of noise factor over the nominal tuning range of the receiver.

1.4. The objective measurement of the gain-limited sensitivity over the nominal tuning range of the receiver. This may be interpreted as the minimum input e.m.f. for which normal contrast may be obtained at the receiver screen and normal sound level may be obtained from the loudspeaker.

1.5. The subjective assessment of self-generated interference. Self-generated interference includes such items as beats between the local-oscillator and harmonics of the i.f., parasitic oscillations in time bases, etc.*

1.6. The objective measurement of the overall luminance-signal response as a function of the video frequency (0 to 5·5 Mc/s) applied as modulation of the radio-frequency input to the receiver.

1.7. The objective measurement of the relative amplitudes of the vision, chrominance and sound carriers at the vision detector, when the receiver is correctly tuned.

### 2. Tests carried out by Research Department

2.1. Objective measurements of tuning accuracy and oscillator drift.

2.2. The subjective and objective measurement of image rejection, including, as image interference, a carrier at Channel (N + 10).

2.3. The subjective and objective measurement of spurious responses. These tests would investigate the response of the receiver to unwanted signals.

2.4. The objective measurement of local-oscillator radiation.

2.5. The objective measurement of the performance of the automatic gain control (a.g.c.) circuits.

2.6. The subjective measurement of self-generated positional and brightness hum.

2.7. The subjective measurement of v.h.f. performance.

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* In some instances hum effects were also included in this assessment

# *APPENDIX II*

## *Results of the Laboratory Tests of 625-line U.H.F. Colour and Monochrome Receivers*

This Appendix summarizes the results of the laboratory tests of u.h.f. monochrome and colour receivers which were made by the BBC Designs and Research Departments during the 1962/63 U.H.F. Field Trials. These results should be read in conjunction with the following notes.

### Notes on the measurements made by Research Department

1. Ratio of the magnitudes of the wanted and interfering signals, for just perceptible interference.

2. To within ± 150 Kc/s of final value.

3. dB rel. 1 $\mu$V, measured across 75 ohms.

4. 1 - Excellent

   2 - Good

   3 - Fairly good

   4 - Rather poor

   5 - Poor

   6 - Very poor

5. Greatest differences in frequency between the actual and nominal values of the vision-carrier intermediate frequency at which reasonable vision and sound signals are obtained.

6. Change in input-signal magnitude required to produce a 1 dB change at the output of the vision detector, starting from the standard value.

General Note: Unless otherwise stated, all Research Department measurements were made using a wanted-signal magnitude of 2 mV open-circuit e.m.f.

### Notes on the measurements made by Designs Department

7. 1 - Imperceptible

   2 - Just perceptible

   3 - Definitely perceptible but not disturbing

   4 - Somewhat objectionable

   5 - Definitely objectionable

   6 - Unusable

8. The maximum increase of the chrominance-signal to luminance-signal ratio that can be made while still retaining satisfactory receiver operation. The maximum increase available was 4 dB.

9. The maximum increase of the sound-signal to luminance-signal ratio that can be made while still retaining satisfactory receiver operation. The maximum increase available was 10 dB.

10. The minimum input-signal magnitude for which acceptable receiver operation can be obtained. The indicated value is the average of five individual assessments.

11. Measured at the input to the vision detector.

12. Measured by applying the video-frequency signal as modulation of the radio-frequency input.

General Note: Unless otherwise stated, all Designs Department measurements were made using a wanted-signal magnitude of 4 mV open-circuit e.m.f.

# MONOCHROME RECEIVER NO. 1

## Measurements carried out by Research Department

| | | | | | | |
|---|---|---|---|---|---|---|
| RESPONSE TO CHANNEL N + 10 | Channel (N) | | 25 | 45 | 60 | Notes:- |
| | Ratio (dB) (1) | | -31 | -34 | -48 | |
| | Attenuation of R.F. stages (dB) | | 41 | 44 | 58 | |
| SPURIOUS RESPONSES | Channel | | | | | Notes:-<br>None |
| | Interfering Signal | Frequency (Mc/s) | | | | |
| | | Ratio (dB) (1) | | | | |
| LOCAL OSCILLATOR | Channel | | 23 | 45 | 60 | Notes:- |
| | Total drift (kc/s) | | - | 370 | - | |
| | Time taken to stabilize (min) (2) | | - | 2½ | - | |
| | P.D. at aerial socket (3) | | 51 | 45 | 44 | |
| I.F. | Nominal frequency of vision carrier (Mc/s) | | | | 38·9 | Notes:- |
| TUNING | Ease of adjustment (4) | | 5 | Notes:- Poor mechanical performance of tuner. Scale error of 6 channel numbers at upper end of band. | | |
| | Limits of range (Mc/s) (5) | Upper | +0·2 | | | |
| | | Lower | -2 | | | |
| A.G.C. | Limits of range (dB) (6) | Upper | 4 | Notes:-<br>Very Poor | | |
| | | Lower | 5 | | | |
| HUM | Positional | Not measured | | V.H.F. PERFORMANCE | Satisfactory See Note (a) | |
| | Amplitude | Not measured | | | | |

Additional Notes:-

(a) 405/625 switch poor mechanically.

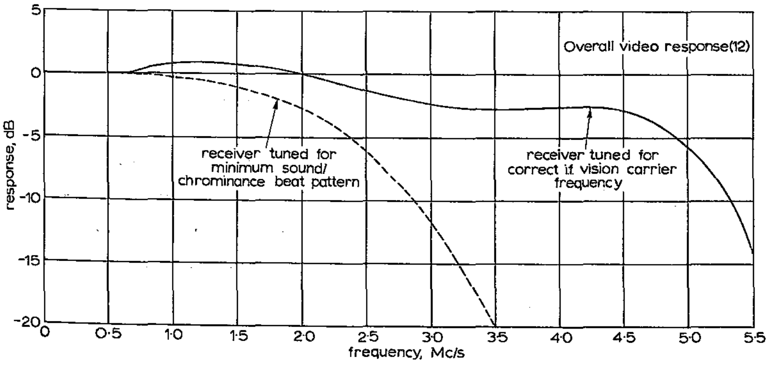
## Measurements carried out by Designs Department

| | | | | |
|---|---|---|---|---|
| SOUND/CHROMINANCE BEAT PATTERN (7) | | 2 | | |
| PERMISSIBLE CARRIER INCREASES | Chrominance sub-carrier (dB) (8) | 2 | | |
| | Sound carrier (dB) (9) | 2 | | |
| NOISE FACTOR | Channel | 21 | 44 | 68 |
| | Noise Factor (dB) | 19·3 | 17·7 | 20 |
| MINIMUM INPUT FOR ACCEPTABLE RECEIVER OPERATION (µV r.m.s.) (10) | | 400 | | |
| SELF-GENERATED PATTERNS (7) | | 1 | | |
| WAVEFORM DISTORTION | Measured 2T pulse-to-bar ratio (%) | 75 | | |
| | K-rating of 2T pulse shape (%) | 2 | | |
| CARRIER AMPLITUDE RATIOS | Sound relative to vision (dB) (11) | -23·5 | | |
| | Chrominance relative to vision (dB) (11) | +4·3 | | |
| | Vision relative to mid-band response (dB) (11) | -5·7 | | |

Additional Notes:-

(b) The U.H.F. tuning control was stiff to turn and the knob was slack, making tuning difficult.

(c) When the receiver was tuned so that the vision carrier in the i.f. was at the design frequency the sound/chrominance beat patterns were found to be objectionable.



## References

| | |
|---|---|
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| Research Department Test Report dated | 16/10/62 |

# MONOCHROME RECEIVER NO. 2

## Measurements carried out by Research Department

| | | | | | | |
|---|---|---|---|---|---|---|
| RESPONSE TO CHANNEL N + 10 | Channel (N) | | 25 | 45 | 60 | Notes:- |
| | Ratio (dB) (1) | | -25 | -27 | -35 | |
| | Attenuation of R.F. stages (dB) | | 47 | 49 | 57 | |
| SPURIOUS RESPONSES | Channel | | | | | Notes:-<br>None |
| | Interfering Signal | Frequency (Mc/s) | | | | |
| | | Ratio (dB) (1) | | | | |
| LOCAL OSCILLATOR | Channel | | 23 | 45 | 60 | Notes:- |
| | Total drift (kc/s) | | - | 380 | - | |
| | Time taken to stabilize (min) (2) | | - | 4 | - | |
| | P.D. at aerial socket (3) | | 50 | 42 | 51 | |
| I.F. | Nominal frequency of vision carrier (Mc/s) | | | | 38·9 | Notes:- |
| TUNING | Ease of adjustment (4) | | 5 | Notes:- Poor mechanical performance of tuner. Scale error of 3 channel numbers at upper end of band. | | |
| | Limits of range (Mc/s) (5) | Upper | +0·2 | | | |
| | | Lower | -2 | | | |
| A.G.C. | Limits of range (dB) ((6) | Upper | 5 | Notes:-<br>Very Poor | | |
| | | Lower | 5 | | | |
| HUM | Positional | Not measured | | | V.H.F. PERFORMANCE | Satisfactory<br>See Note (a) |
| | Amplitude | Not measured | | | | |

Additional Notes:-

(a) 405/625 switch poor mechanically.

## Measurements carried out by Designs Department

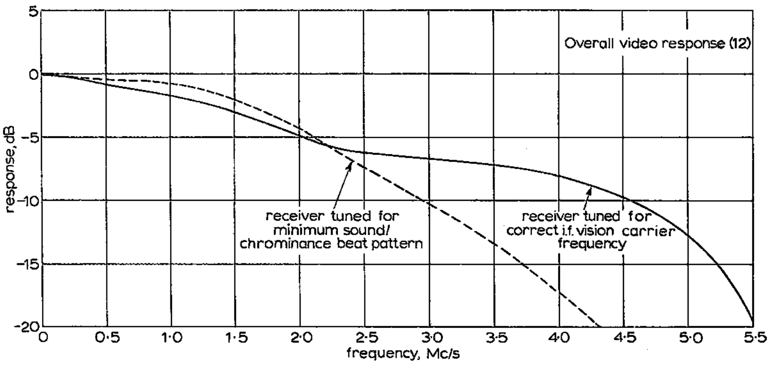
| | | | | |
|---|---|---|---|---|
| SOUND/CHROMINANCE BEAT PATTERN (7) | | 3 | | |
| PERMISSIBLE CARRIER INCREASES | Chrominance sub-carrier (dB) (8) | 2 | | |
| | Sound carrier (dB) (9) | 2 | | |
| NOISE FACTOR | Channel | 21 | 44 | 68 |
| | Noise Factor (dB) | 15·8 | 14·2 | 13·7 |
| MINIMUM INPUT FOR ACCEPTABLE RECEIVER OPERATION ($\mu$V r.m.s.) | | 870 (10) | | |
| SELF-GENERATED PATTERNS (7) | | 1 | | |
| WAVEFORM DISTORTION | Measured 2T pulse-to-bar ratio (%) | 100 | | |
| | K-rating of 2T pulse shape (%) | 2 | | |
| CARRIER AMPLITUDE RATIOS | Sound relative to vision (dB) (11) | -26 | | |
| | Chrominance relative to vision (dB) (11) | -1 | | |
| | Vision relative to mid-band response (dB) (11) | -5 | | |

Additional Notes:-

(b) The U.H.F. tuning control was stiff to turn and the knob was slack, making tuning difficult.

(c) There appeared to be little or no A.G.C. This may have been due to a fault condition but was not investigated.

(d) When the receiver was tuned so that the vision carrier in the i.f. was at the design frequency the sound/chrominance beat patterns were found to be objectionable.



## References

| | |
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| Research Department Test Report dated | 16/10/62 |

# MONOCHROME RECEIVER NO. 3

## Measurements carried out by Research Department

| | | | | | | |
|---|---|---|---|---|---|---|
| RESPONSE TO CHANNEL N + 10 | Channel (N) | | 25 | 45 | 64 | Notes:- |
| | Ratio (dB) (1) | | -15 | -23 | -27 | |
| | Attenuation of R.F. stages (dB) | | 41 | 49 | 53 | |
| SPURIOUS RESPONSES | Channel | | | | | Notes:-<br>None |
| | Inter-fering Signal | Frequency (Mc/s) | | | | |
| | | Ratio (dB) (1) | | | | |
| LOCAL OSCIL-LATOR | Channel | | 23 | 44 | 64 | Notes:- |
| | Total drift (kc/s) | | - | 150 | - | |
| | Time taken to stabilize (min) (2) | | - | 0 | - | |
| | P.D. at aerial socket (3) | | 59 | 45 | 57 | |
| I.F. | Nominal frequency of vision carrier (Mc/s) | | | | 39·5 | Notes:- |
| TUNING | Ease of adjustment (4) | | 3 | | | Notes:- Tuner dial accurate and easy to read. |
| | Limits of range (Mc/s) (5) | Upper | +0·2 | | | |
| | | Lower | -1·7 | | | |
| A.G.C. | Limits of range (dB) (6) | Upper | 34 | | | Notes:- |
| | | Lower | 22 | | | |
| HUM | Positional | Not measured | | | V.H.F. PERFORMANCE | Satisfactory See Note (a) |
| | Amplitude | Not measured | | | | |

Additional Notes:-

(a) When switching between the V.H.F. and U.H.F. ranges, up to one minute elapses before the new signal appears.

## Measurements carried out by Designs Department

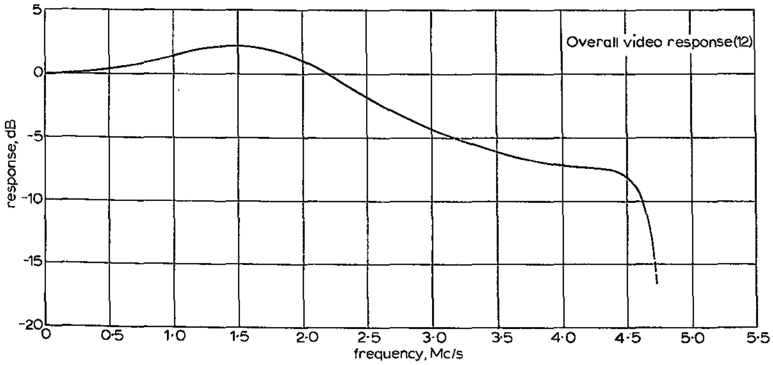
| | | | | |
|---|---|---|---|---|
| SOUND/CHROMINANCE BEAT PATTERN (7) | | 1 | | |
| PERMISSIBLE CARRIER INCREASES | Chrominance sub-carrier (dB) (8) | >4 | | |
| | Sound carrier (dB) (9) | >10 | | |
| NOISE FACTOR | Channel | 21 | 39 | 69 |
| | Noise Factor (dB) | 15·8 | 14·2 | 14·3 |
| MINIMUM INPUT FOR ACCEPTABLE RECEIVER OPERATION ($\mu$V r.m.s.) (10) | | 700 | | |
| SELF-GENERATED PATTERNS (7) | | 1 | | |
| WAVEFORM DISTORTION | Measured 2T pulse-to-bar ratio (%) | 80 | | |
| | K-rating of 2T pulse shape (%) | 5 | | |
| CARRIER AMPLITUDE RATIOS | Sound relative to vision (dB) (11) | -30·5 | | |
| | Chrominance relative to vision (dB) (11) | +3·5 | | |
| | Vision relative to mid-band response (dB) (11) | -7 | | |

Additional Notes:-

(b) The flyback was slow and when a line test signal was present in the vertical interval this appeared in the picture.

(c) The brilliance and contrast controls were interdependent.

(d) Owing to the fact that separate i.f. strips are used in the 405- and 625-line positions, when switching from V.H.F. to U.H.F. and vice versa, a wait of 30 seconds is necessary whilst the valves warm up.



## References

| | |
|---|---|
| Designs Department Test Report No. | 6 · 276 |
| Research Department Test Report dated | 1/11/62 |

# MONOCHROME RECEIVER NO. 3a

## Measurements carried out by Research Department

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| RESPONSE TO CHANNEL N + 10 | Channel (N) | | 24 | 44 | 60 | Notes:- | Additional Notes:-<br>(a) Fitted with 4-gang u.h.f. tuner. |
| | Ratio (dB) (1) | | -19 | -22 | -24 | | |
| | Attenuation of R.F. stages (dB) | | 62 | 65 | 67 | | |
| SPURIOUS RESPONSES | Channel | | | | | Notes:-<br>None | |
| | Interfering Signal | Frequency (Mc/s) | | | | | |
| | | Ratio (dB) (1) | | | | | |
| LOCAL OSCILLATOR | Channel | | 24 | 44 | 60 | Notes:- | |
| | Total drift (kc/s) | | 250 | - | - | These stability measurements taken on Channel 33. | |
| | Time taken to stabilize (min) (2) | | 4½ | - | - | | |
| | P.D. at aerial socket (3) | | 56 | 43 | 39 | | |
| I.F. | Nominal frequency of vision carrier (Mc/s) | | | | 39·5 | Notes:- | |
| TUNING | Ease of adjustment (4) | | 2 | Notes:- | | | |
| | Limits of range (Mc/s) (5) | Upper | +0·3 | Tuner dial accurate and easy to read. | | | |
| | | Lower | -2·8 | | | | |
| A.G.C. | Limits of range (dB) ((6) | Upper | 28 | Notes:-<br>Picture very noisy at lower limit. | | | |
| | | Lower | 21 | | | | |
| HUM | Positional | Just perceptible | | V.H.F. PERFORMANCE | Satisfactory | | |
| | Amplitude | Perceptible | | | | | |

## Measurements carried out by Designs Department

| | | | | | |
|---|---|---|---|---|---|
| SOUND/CHROMINANCE BEAT PATTERN (7) | | | | | Additional Notes:-<br>(b) No measurements were made on this receiver by Designs Department. |
| PERMISSIBLE CARRIER INCREASES | Chrominance sub-carrier (dB) (8) | | | | |
| | Sound carrier (dB) (9) | | | | |
| NOISE FACTOR | Channel | | | | |
| | Noise Factor (dB) | | | | |
| MINIMUM INPUT FOR ACCEPTABLE RECEIVER OPERATION (μV r.m.s.) (10) | | | | | |
| SELF-GENERATED PATTERNS (7) | | | | | |
| WAVEFORM DISTORTION | Measured 2T pulse-to-bar ratio (%) | | | | |
| | K-rating of 2T pulse shape (%) | | | | |
| CARRIER AMPLITUDE RATIOS | Sound relative to vision (dB) (11) | | | | |
| | Chrominance relative to vision (dB) (11) | | | | |
| | Vision relative to mid-band response (dB) (11) | | | | |

### References

| | |
|---|---|
| Designs Department Test Report No. | |
| Research Department Test Report dated | 10/10/63 |

# MONOCHROME RECEIVER NO. 4

## Measurements carried out by Research Department

| | | | | | | |
|---|---|---|---|---|---|---|
| RESPONSE TO CHANNEL N + 10 | Channel (N) | | 25 | 45 | 64 | Notes:- |
| | Ratio (dB) (1) | | -42 | -34 | -38 | |
| | Attenuation of R.F. stages (dB) | | 71 | 63 | 67 | |
| SPURIOUS RESPONSES | Channel | | | | | Notes:-<br>None |
| | Interfering Signal | Frequency (Mc/s) | | | | |
| | | Ratio (dB) (1) | | | | |
| LOCAL OSCILLATOR | Channel | | 23 | 44 | 64 | Notes:- |
| | Total drift (kc/s) | | - | 190 | - | |
| | Time taken to stabilize (min) (2) | | - | 2 | - | |
| | P.D. at aerial socket (3) | | 39 | 38 | 32 | |
| I.F. | Nominal frequency of vision carrier (Mc/s) | | | | 39·5 | Notes:- |
| TUNING | Ease of adjustment (4) | | 5 | Notes:-<br>See Note (a) | | |
| | Limits of range (Mc/s) (5) | Upper | +0·3 | | | |
| | | Lower | -0·2 | | | |
| A.G.C. | Limits of range (dB) (6) | Upper | 34 | Notes:- | | |
| | | Lower | 24 | | | |
| HUM | Positional | Not measured | | V.H.F. PERFORMANCE | Designed for Continental standards. | |
| | Amplitude | Not measured | | | | |

Additional Notes:-

(a) The lower tuning limit is set by sound quality and the upper limit by picture quality. However, the sound quality improves further if tuning is carried beyond this upper limit, and this makes the choosing of the best tuning point difficult. This difficulty is increased by the presence of backlash in the drive mechanism.

## Measurements carried out by Designs Department

| | | | | |
|---|---|---|---|---|
| SOUND/CHROMINANCE BEAT PATTERN (7) | | 2 | | |
| PERMISSIBLE CARRIER INCREASES | Chrominance sub-carrier (dB) (8) | 3 | | |
| | Sound carrier (dB) (9) | 8 | | |
| NOISE FACTOR | Channel | 21 | 34 | 69 |
| | Noise Factor (dB) | 13·9 | 14·3 | 17·2 |
| MINIMUM INPUT FOR ACCEPTABLE RECEIVER OPERATION (μV r.m.s.) | | 600 (10) | | |
| SELF-GENERATED PATTERNS (7) | | 1 | | |
| WAVEFORM DISTORTION | Measured 2T pulse-to-bar ratio (%) | 67 | | |
| | K-rating of 2T pulse shape (%) | 8 | | |
| CARRIER AMPLITUDE RATIOS | Sound relative to vision (dB) (11) | -31 | | |
| | Chrominance relative to vision (dB) (11) | +3·2 | | |
| | Vision relative to mid-band response (dB) (11) | -4·5 | | |

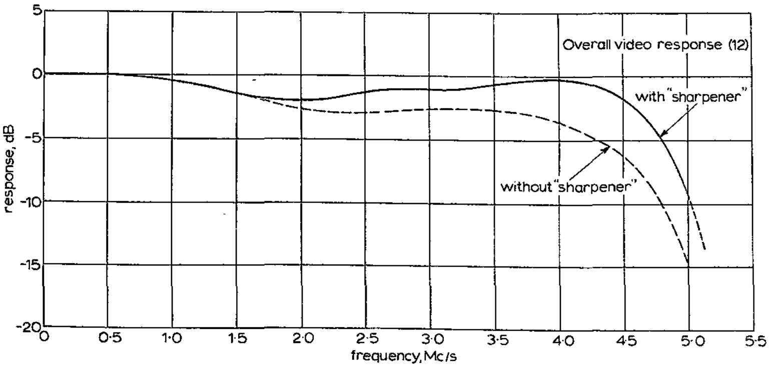
Additional Notes:-

(b) A control marked "Scharfzeichner" was fitted which, when operated, increased the response at the higher video frequencies (see overall video response curves).

(c) The tuning range over which sound and vision were present together was restricted.

(d) Backlash on the control made tuning rather difficult.

(e) The receiver was an export model and was not therefore dual standard.



## References

| | |
|---|---|
| Designs Department Test Report No. | 6·277 |
| Research Department Test Report dated | 1/11/62 |

# MONOCHROME RECEIVER NO. 5

## Measurements carried out by Research Department

| | | | | | | |
|---|---|---|---|---|---|---|
| RESPONSE TO CHANNEL N + 10 | Channel (N) | | 25 | 45 | 64 | Notes:- |
| | Ratio (dB) (1) | | -40 | -39 | -35 | |
| | Attenuation of R.F. stages (dB) | | 65 | 64 | 60 | |
| SPURIOUS RESPONSES | Channel | | | | | Notes:-<br>None |
| | Interfering Signal | Frequency (Mc/s) | | | | |
| | | Ratio (dB) (1) | | | | |
| LOCAL OSCILLATOR | Channel | | 23 | 44 | 64 | Notes:- |
| | Total drift (kc/s) | | - | 150 | - | |
| | Time taken to stabilize (min) (2) | | - | 0 | - | |
| | P.D. at aerial socket (3) | | 50 | 49 | 49 | |
| I.F. | Nominal frequency of vision carrier (Mc/s) | | | | 39·5 | Notes:- |
| TUNING | Ease of adjustment (4) | | 4 | | | Notes:- |
| | Limits of range (Mc/s) (5) | Upper | 0 | | | |
| | | Lower | -1·2 | | | |
| A.G.C. | Limits of range (dB) (6) | Upper | 9 | | | Notes:-<br>Poor |
| | | Lower | 11 | | | |
| HUM | Positional | Not measured | | | V.H.F. PERFORMANCE | Satisfactory |
| | Amplitude | Not measured | | | | |

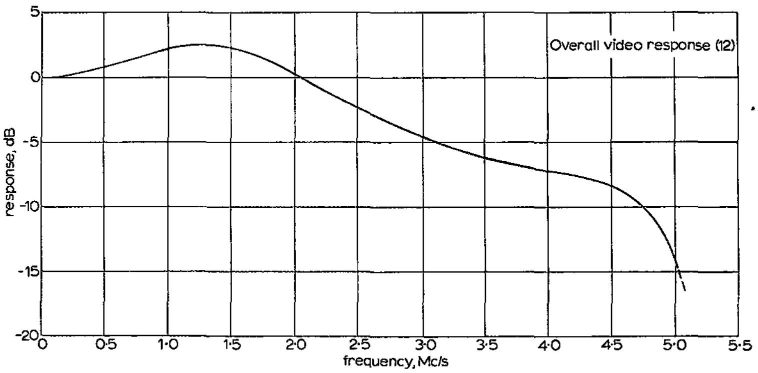
Additional Notes:-

## Measurements carried out by Designs Department

| | | | | |
|---|---|---|---|---|
| SOUND/CHROMINANCE BEAT PATTERN (7) | | 2 | | |
| PERMISSIBLE CARRIER INCREASES | Chrominance sub-carrier (dB) (8) | >4 | | |
| | Sound carrier (dB) (9) | 7 | | |
| NOISE FACTOR | Channel | 21 | 34 | 68 |
| | Noise Factor (dB) | 15 | 15·3 | 19·5 |
| MINIMUM INPUT FOR ACCEPTABLE RECEIVER OPERATION ($\mu$V r.m.s.) (10) | | 420 | | |
| SELF-GENERATED PATTERNS (7) | | 1 | | |
| WAVEFORM DISTORTION | Measured 2T pulse-to-bar ratio (%) | 87 | | |
| | K-rating of 2T pulse shape (%) | 8 | | |
| CARRIER AMPLITUDE RATIOS | Sound relative to vision (dB) (11) | -30 | | |
| | Chrominance relative to vision (dB) (11) | +6 | | |
| | Vision relative to mid-band response (dB) (11) | -6 | | |

Additional Notes:-

(a) The tuning control was found to be rather coarse, and care was required in its operation. There was negligible backlash.



## References

| | |
|---|---|
| Designs Department Test Report No. | 6·278 |
| Research Department Test Report dated | 1/11/62 |

# MONOCHROME RECEIVER NO. 6

## Measurements carried out by Research Department

| | | | | | | |
|---|---|---|---|---|---|---|
| **RESPONSE TO CHANNEL N + 10** | Channel (N) | | 25 | 45 | 64 | Notes:- |
| | Ratio (dB) (1) | | -18 | -20 | -16 | |
| | Attenuation of R.F. stages (dB) | | 48 | 50 | 46 | |
| **SPURIOUS RESPONSES** | Channel | | 25 | 45 | 64 | Notes:- |
| | Inter-fering Signal | Frequency (Mc/s) | 540 | 697 | 853 | |
| | | Ratio (dB) (1) | 7 | 8 | -8 | |
| **LOCAL OSCIL-LATOR** | Channel | | 27 | 44 | 64 | Notes:- |
| | Total drift (kc/s) | | - | 310 | - | |
| | Time taken to stabilize (min) (2) | | - | 2½ | - | |
| | P.D. at aerial socket (3) | | 63 | 52 | 51 | |
| **I.F.** | Nominal frequency of vision carrier (Mc/s) | | | | 39·5 | Notes:- |
| **TUNING** | Ease of adjustment (4) | | 4 | Notes:- No reference point is provided for the "channel number" calibrations on the tuning knob. | | |
| | Limits of range (Mc/s) (5) | Upper | -0·2 | | | |
| | | Lower | -2·5 | | | |
| **A.G.C.** | Limits of range (dB) (6) | Upper | 38 | Notes:- | | |
| | | Lower | 12 | | | |
| **HUM** | Positional | Imperceptible | | V.H.F. PERFORMANCE | Satisfactory | |
| | Amplitude | Imperceptible | | | | |

Additional Notes:-

(a) Hard lock line time-base.

## Measurements carried out by Designs Department

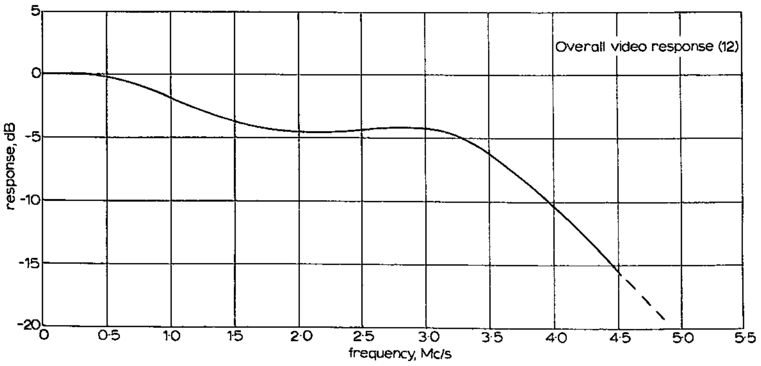
| | | | | |
|---|---|---|---|---|
| **SOUND/CHROMINANCE BEAT PATTERN** (7) | | 2 | | |
| **PERMISSIBLE CARRIER INCREASES** | Chrominance sub-carrier (dB) (8) | not measured | | |
| | Sound carrier (dB) (9) | 8 | | |
| **NOISE FACTOR** | Channel | 21 | 34 | 68 |
| | Noise Factor (dB) | 16 | 18 | 19 |
| **MINIMUM INPUT FOR ACCEPTABLE RECEIVER OPERATION ($\mu$V r.m.s.)** (10) | | 800 | | |
| **SELF-GENERATED PATTERNS** (7) | | 2 See Note (d) | | |
| **WAVEFORM DISTORTION** | Measured 2T pulse-to-bar ratio (%) | 50 | | |
| | K-rating of 2T pulse shape (%) | >10 | | |
| **CARRIER AMPLITUDE RATIOS** | Sound relative to vision (dB) (11) | -24 | | |
| | Chrominance relative to vision (dB) (11) | +3 | | |
| | Vision relative to mid-band response (dB) (11) | -6 | | |

Additional Notes:-

(b) To eliminate sound/chrominance beat patterns the receiver had to be de-tuned so that loss of picture quality resulted.

(c) The tuning knob was sloppy and had a certain amount of backlash.

(d) Line-tearing was noticed on certain types of picture. Mush and a moving 'hum' bar became visible when the input level was reduced from the normal test level of 4 mV.



## References

| | |
|---|---|
| Designs Department Test Report No. | 6·283 |
| Research Department Test Report dated | 17/12/62 |

# MONOCHROME RECEIVER NO. 7

## Measurements carried out by Research Department

| | | | | | | |
|---|---|---|---|---|---|---|
| RESPONSE TO CHANNEL N + 10 | Channel (N) | | 25 | 45 | 64 | Notes:- Measurements carried out with I.F. vision carrier frequency of 38·5 Mc/s |
| | Ratio (dB) (1) | | -44 | -40 | -35 | |
| | Attenuation of R.F. stages (dB) | | 47 | 43 | 38 | |
| SPURIOUS RESPONSES | Channel | | | | | Notes:- None |
| | Interfering Signal | Frequency (Mc/s) | | | | |
| | | Ratio (dB) (1) | | | | |
| LOCAL OSCILLATOR | Channel | | 27 | 44 | 64 | Notes:- |
| | Total drift (kc/s) | | - | 850 | - | |
| | Time taken to stabilize (min) (2) | | - | 12½ | - | |
| | P.D. at aerial socket (3) | | 60 | 54 | 53 | |
| I.F. | Nominal frequency of vision carrier (Mc/s) | | | | 39·5 | Notes:- |
| TUNING | Ease of adjustment (4) | | 2 | Notes:- Good mechanical performance of tuning mechanism, but errors of up to four channel numbers in tuner dial reading. | | |
| | Limits of range (Mc/s) (5) | Upper | 0 | | | |
| | | Lower | -3·0 | | | |
| A.G.C. | Limits of range (dB) (6) | Upper | 3 | Notes:- Very poor | | |
| | | Lower | 5 | | | |
| HUM | Positional | Imperceptible | | V.H.F. PERFORMANCE | Satisfactory | |
| | Amplitude | Imperceptible | | | | |

Additional Notes:-

## Measurements carried out by Designs Department

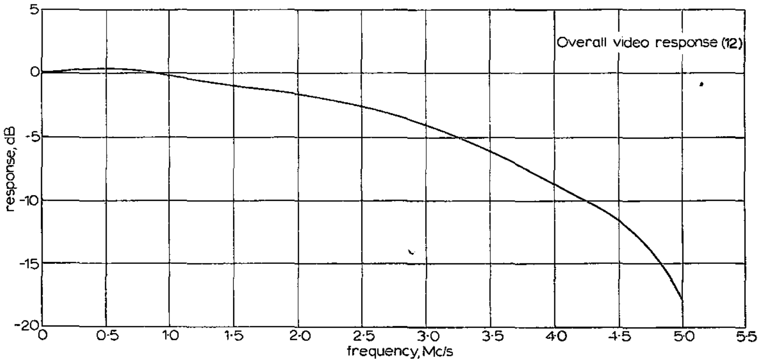
| | | | | |
|---|---|---|---|---|
| SOUND/CHROMINANCE BEAT PATTERN (7) | | 1 | | |
| PERMISSIBLE CARRIER INCREASES | Chrominance sub-carrier (dB) (8) | not measured | | |
| | Sound carrier (dB) (9) | 8 | | |
| NOISE FACTOR | Channel | 21 | 34 | 65 |
| | Noise Factor (dB) | 12·5 | 14·5 | 20 |
| MINIMUM INPUT FOR ACCEPTABLE RECEIVER OPERATION (μV r.m.s.) | | 1000 See Note (c) (10) | | |
| SELF-GENERATED PATTERNS (7) | | 2 See Note (b) | | |
| WAVEFORM DISTORTION | Measured 2T pulse-to-bar ratio (%) | 80 | | |
| | K-rating of 2T pulse shape (%) | 5 | | |
| CARRIER AMPLITUDE RATIOS | Sound relative to vision (dB) (11) | -28 | | |
| | Chrominance relative to vision (dB) (11) | +6 | | |
| | Vision relative to mid-band response (dB) (11) | -6 | | |

Additional Notes:-

(a) A small amount of backlash was noticeable on the tuning control but this was not sufficient to cause trouble.

(b) A vertical pattern of approximately 75 kc/s was visible on the screen on dark pictures. It is not visible in the block portion of bright scenes owing to AGC action.

(c) The minimum input level was limited by lack of contrast, which may be caused by a lack of gain.



## References

| | |
|---|---|
| Designs Department Test Report No. | 6·281 |
| Research Department Test Report dated | 17/12/62 |

# MONOCHROME RECEIVER NO. 8

## Measurements carried out by Research Department

| | | | | | | |
|---|---|---|---|---|---|---|
| RESPONSE TO CHANNEL N + 10 | Channel (N) | | 25 | 45 | 64 | Notes:- |
| | Ratio (dB) (1) | | -31 | -32 | -34 | |
| | Attenuation of R.F. stages (dB) | | 60 | 61 | 63 | |
| SPURIOUS RESPONSES | Channel | | | | | Notes:-<br>None |
| | Interfering Signal | Frequency (Mc/s) | | | | |
| | | Ratio (dB) (1) | | | | |
| LOCAL OSCILLATOR | Channel | | 30 | 44 | 64 | Notes:- |
| | Total drift (kc/s) | | - | 660 | - | |
| | Time taken to stabilize (min) (2) | | - | 22½ | - | |
| | P.D. at aerial socket (3) | | 39 | 35 | 48 | |
| I.F. | Nominal frequency of vision carrier (Mc/s) | | 39·4 | | | Notes:- |
| TUNING | Ease of adjustment (4) | | 4 | | | Notes:- Tuning mechanism very stiff. Only one speed of adjustment (slow) is provided. |
| | Limits of range (Mc/s) (5) | Upper | +0·6 | | | |
| | | Lower | -0·9 | | | |
| A.G.C. | Limits of range (dB) (6) | Upper | 18 | | | Notes:-<br>See Note (a) |
| | | Lower | 22 | | | |
| HUM | Positional | Noticeable | | | V.H.F. PERFORMANCE | Satisfactory<br>See Note (b) |
| | Amplitude | Imperceptible | | | | |

Additional Notes:-

(a) Amended values.

(b) Two switching operations are required to change between U.H.F. and V.H.F. reception.

(c) Overall picture quality rather poor for both U.H.F. and V.H.F. reception.

## Measurements carried out by Designs Department

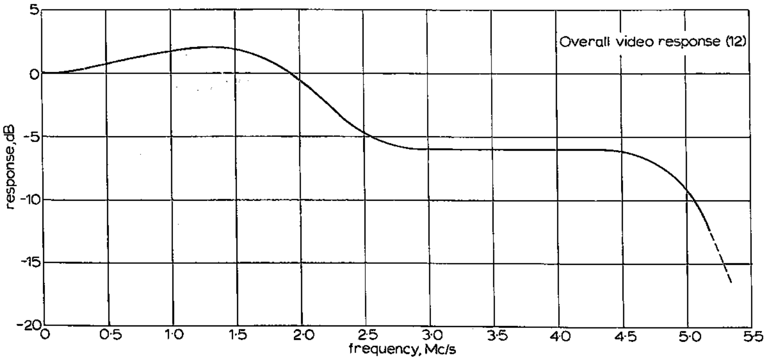
| | | | | |
|---|---|---|---|---|
| SOUND/CHROMINANCE BEAT PATTERN (7) | | 1 | | |
| PERMISSIBLE CARRIER INCREASES | Chrominance sub-carrier (dB) (8) | not measured | | |
| | Sound carrier (dB) (9) | >10 | | |
| NOISE FACTOR | Channel | 22 | 35 | 66 |
| | Noise Factor (dB) | 16 | 16·6 | 20 |
| MINIMUM INPUT FOR ACCEPTABLE RECEIVER OPERATION ($\mu$V r.m.s.) | | 280 (10) | | |
| SELF-GENERATED PATTERNS (7) | | 1 | | |
| WAVEFORM DISTORTION | Measured 2T pulse-to-bar ratio (%) | 78 | | |
| | K-rating of 2T pulse shape (%) | 5 | | |
| CARRIER AMPLITUDE RATIOS | Sound relative to vision (dB) (11) | -31 | | |
| | Chrominance relative to vision (dB) (11) | 0 | | |
| | Vision relative to mid-band response (dB) (11) | -5·5 | | |

Additional Notes:-

(d) The tuning control tends to alter the tuning in a series of small steps instead of a continuous movement.

(e) The system switch is stiff to operate.

(f) The plastic window mounted in front of the tube attracted dust.



### References

| | |
|---|---|
| Designs Department Test Report No. | 6·291 |
| Research Department Test Report dated | 14/2/63 |

# MONOCHROME RECEIVER NO. 9

## Measurements carried out by Research Department

| | | | | | | |
|---|---|---|---|---|---|---|
| RESPONSE TO CHANNEL N + 10 | Channel (N) | | 25 | 45 | 64 | Notes:- |
| | Ratio (dB) (1) | | -8 | -8 | -8 | |
| | Attenuation of R.F. stages (dB) | | 48 | 48 | 48 | |
| SPURIOUS RESPONSES | Channel | | | | | Notes:-<br>None |
| | Interfering Signal | Frequency (Mc/s) | | | | |
| | | Ratio (dB) (1) | | | | |
| LOCAL OSCILLATOR | Channel | | 30 | 44 | 64 | Notes:- |
| | Total drift (kc/s) | | - | 220 | - | |
| | Time taken to stabilize (min) (2) | | - | 2½ | - | |
| | P.D. at aerial socket (3) | | 49 | 47 | 49 | |
| I.F. | Nominal frequency of vision carrier (Mc/s) | | | | 39·5 | Notes:- |
| TUNING | Ease of adjustment (4) | | 2 | | | Notes:-<br>Clear tuning scale. Only one speed of adjustment (slow) is provided. |
| | Limits of range (Mc/s) (5) | Upper | +0·5 | | | |
| | | Lower | -0·7 | | | |
| A.G.C. | Limits of range (dB) (6) | Upper | 13 | | | Notes:- |
| | | Lower | 10 | | | |
| HUM | Positional | Noticeable | | V.H.F. PERFORMANCE | Satisfactory | |
| | Amplitude | Imperceptible | | | | |

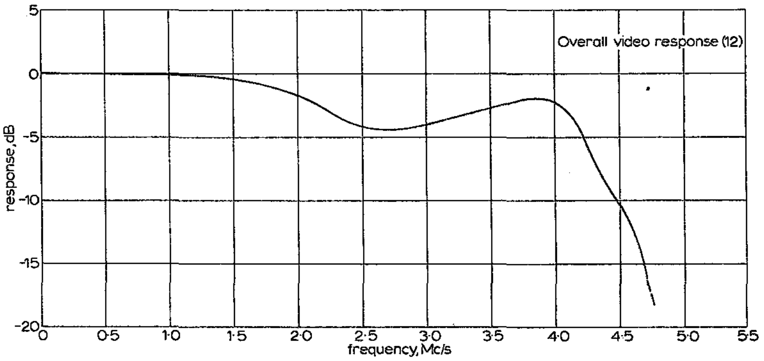
Additional Notes:-

## Measurements carried out by Designs Department

| | | | | | |
|---|---|---|---|---|---|
| SOUND/CHROMINANCE BEAT PATTERN (7) | | 2 | | | |
| PERMISSIBLE CARRIER INCREASES | Chrominance sub-carrier (dB) (8) | not measured | | | |
| | Sound carrier (dB) (9) | 7 | | | |
| NOISE FACTOR | Channel | 22 | 35 | 65 | |
| | Noise Factor (dB) | 11·5 | 12·4 | 13·1 | |
| MINIMUM INPUT FOR ACCEPTABLE RECEIVER OPERATION ($\mu$V r.m.s.) | | 190 (10) | | | |
| SELF-GENERATED PATTERNS (7) | | 2 | | | |
| WAVEFORM DISTORTION | Measured 2T pulse-to-bar ratio (%) | 82 | | | |
| | K-rating of 2T pulse shape (%) | 4 | | | |
| CARRIER AMPLITUDE RATIOS | Sound relative to vision (dB) (11) | -34 | | | |
| | Chrominance relative to vision (dB) (11) | -0·3 | | | |
| | Vision relative to mid-band response (dB) (11) | -7 | | | |

Additional Notes:-

(a) The tuning control is too fine to tune readily between channels.



### References

| | |
|---|---|
| Designs Department Test Report No. | 6·295 |
| Research Department Test Report dated | 14/2/63 |

# MONOCHROME RECEIVER NO. 10

## Measurements carried out by Research Department

| | | | | | | |
|---|---|---|---|---|---|---|
| RESPONSE TO CHANNEL N + 10 | Channel (N) | | 25 | 45 | 64 | Notes:- |
| | Ratio (dB) (1) | | -25 | -30 | -35 | |
| | Attenuation of R.F. stages (dB) | | 58 | 63 | 68 | |
| SPURIOUS RESPONSES | Channel | | | | | Notes:-<br>None |
| | Interfering Signal | Frequency (Mc/s) | | | | |
| | | Ratio (dB) (1) | | | | |
| LOCAL OSCILLATOR | Channel | | 30 | 44 | 64 | Notes:- |
| | Total drift (kc/s) | | - | 330 | - | |
| | Time taken to stabilize (min) (2) | | - | 3½ | - | |
| | P.D. at aerial socket (3) | | 39 | 27 | 34 | |
| I.F. | Nominal frequency of vision carrier (Mc/s) | | | | 39·4 | Notes:- |
| TUNING | Ease of adjustment (4) | | 4 | Notes:- Tuning mechanism very stiff. Only one speed of adjustment (slow) is provided. | | |
| | Limits of range (Mc/s) (5) | Upper | +0·1 | | | |
| | | Lower | -0·9 | | | |
| A.G.C. | Limits of range (dB) (6) | Upper | 13 | Notes:- | | |
| | | Lower | 17 | | | |
| HUM | Positional | Noticeable | | V.H.F. PERFORMANCE | Satisfactory | |
| | Amplitude | Imperceptible | | | | |

Additional Notes:-

(a) Two switching operations are required to change between U.H.F. and V.H.F. reception.

## Measurements carried out by Designs Department

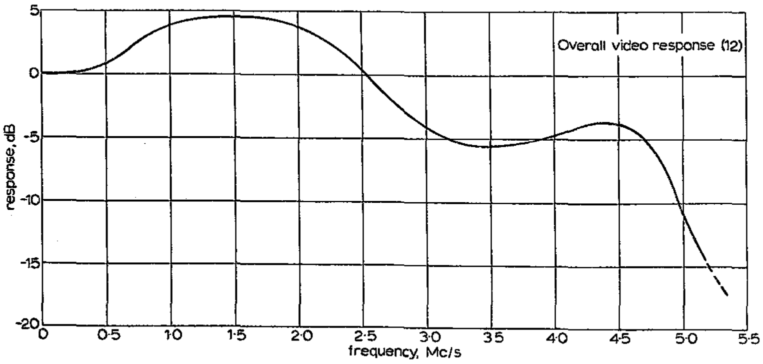
| | | | | |
|---|---|---|---|---|
| SOUND/CHROMINANCE BEAT PATTERN (7) | | 2 | | |
| PERMISSIBLE CARRIER INCREASES | Chrominance sub-carrier (dB) (8) | not measured | | |
| | Sound carrier (dB) (9) | 9 | | |
| NOISE FACTOR | Channel | 22 | 35 | 66 |
| | Noise Factor (dB) | 15 | 18·6 | 20 |
| MINIMUM INPUT FOR ACCEPTABLE RECEIVER OPERATION (μV r.m.s.) | | 390 (10) | | |
| SELF-GENERATED PATTERNS (7) | | 2 | | |
| WAVEFORM DISTORTION | Measured 2T pulse-to-bar ratio (%) | 120 | | |
| | K-rating of 2T pulse shape (%) | 10 | | |
| CARRIER AMPLITUDE RATIOS | Sound relative to vision (dB) (11) | -30 | | |
| | Chrominance relative to vision (dB) (11) | 0 | | |
| | Vision relative to mid-band response (dB) (11) | -4 | | |

Additional Notes:-

(b) The tuning control tends to alter the tuning in a series of small steps instead of a continuous movement.

(c) The system switch was stiff to operate.

(d) The plastic window mounted in front of the tube attracted dust.



## References

| | |
|---|---|
| Designs Department Test Report No. | 6·294 |
| Research Department Test Report dated | 14/2/63 |

# MONOCHROME RECEIVER NO. 11

## Measurements carried out by Research Department

| | | | | | | |
|---|---|---|---|---|---|---|
| RESPONSE TO CHANNEL N + 10 | Channel (N) | | 34 | 44 | | Notes:- See notes (a) to (d) below. |
| | Ratio (dB) (1) | | 15 | -10 | | |
| | Attenuation of R.F. stages (dB) | | 6 | 31 | | |
| SPURIOUS RESPONSES | Channel | | | | | Notes:- None |
| | Interfering Signal | Frequency (Mc/s) | | | | |
| | | Ratio (dB) (1) | | | | |
| LOCAL OSCILLATOR | Channel | | 34 | 44 | - | Notes:- On switching from one channel to the other, without re-adjusting the fine tuning control, the I.F. vision carrier changed in frequency by 270 kc/s. |
| | Total drift (kc/s) | | - | 90 | - | |
| | Time taken to stabilize (min) (2) | | - | - | - | |
| | P.D. at aerial socket (3) | | 70 | 74 | - | |
| I.F. | Nominal frequency of vision carrier (Mc/s) | | | | 45·75 | Notes:- No interference from Channel 1 noticed. |
| TUNING | Ease of adjustment (4) | | 1 | | | Notes:- See note (b) below. |
| | Limits of range (Mc/s) (5) | Upper | -0·15 | | | |
| | | Lower | -2 | | | |
| A.G.C. | Limits of range (dB) (6) | Upper | >40 | | | Notes:- |
| | | Lower | 18 | | | |
| HUM | Positional | Perceptible | | | V.H.F. PERFORMANCE | Nil |
| | Amplitude | Imperceptible | | | | |

Additional Notes:-

(a) The receiver was very insensitive on Channel 34, and the low R.F. attenuation on this channel is believed to be due to a fault in the tuner.

(b) The tuner is switch-tuned and it is not possible to receive channels other than 34 and 44. To avoid interference from the Crystal Palace emissions the input signal level was increased to 20 mV open-circuit e.m.f.

(c) An I.F. vision carrier of 45 Mc/s was used for these measurements.

(d) The interference produced by the N + 10th channel is due to the image sound carrier falling within the I.F. pass-band. The levels quoted are those of the vision carrier, due allowance having been made for the sound/vision carrier power ratio.

## Measurements carried out by Designs Department

| | | |
|---|---|---|
| SOUND/CHROMINANCE BEAT PATTERN (7) | | 3 |
| PERMISSIBLE CARRIER INCREASES | Chrominance sub-carrier (dB) (8) | not measured |
| | Sound carrier (dB) (9) | 8 |
| NOISE FACTOR | Channel | 42 |
| | Noise Factor (dB) | 18 |
| MINIMUM INPUT FOR ACCEPTABLE RECEIVER OPERATION ($\mu$V r.m.s.) (10) | | 1600 See Note (e) |
| SELF-GENERATED PATTERNS (7) | | 4 See Note (g) |
| WAVEFORM DISTORTION | Measured 2T pulse-to-bar ratio (%) | 82 |
| | K-rating of 2T pulse shape (%) | 5 |
| CARRIER AMPLITUDE RATIOS | Sound relative to vision (dB) (11) | -37 |
| | Chrominance relative to vision (dB) (11) | -5·5 |
| | Vision relative to mid-band response (dB) (11) | -4·5 |

Additional Notes:-

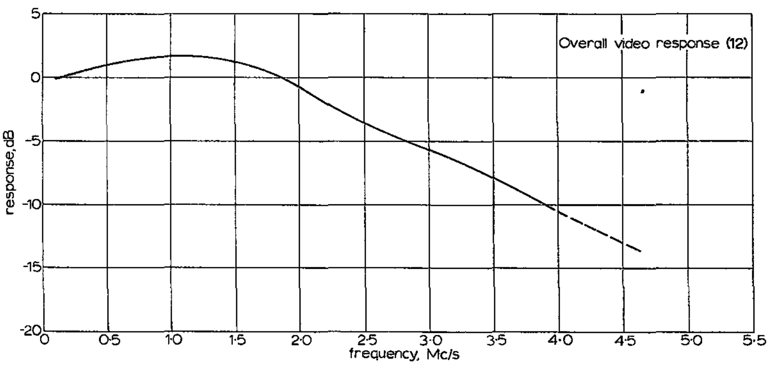
(e) The receiver input impedance is 300 Ω.

(f) Pictures are not of very good quality.

(g) Patterns due to microphony are noticeable.

(h) The video response is thought to be rather poor.

(i) Trouble may be experienced when operating the receiver near a Channel 1 transmitter due to the i.f. falling in this band.



## References

| | |
|---|---|
| Designs Department Test Report No. | 6·293 |
| Research Department Test Report dated | 28/3/63 |

# MONOCHROME RECEIVER NO. 12

## Measurements carried out by Research Department

| | | | | | | |
|---|---|---|---|---|---|---|
| **RESPONSE TO CHANNEL N + 10** | Channel (N) | | 25 | 45 | 64 | Notes:-<br>See Notes (a) and (b) |
| | Ratio (dB) (1) | | 7 | 6 | 8 | |
| | Attenuation of R.F. stages (dB) | | 37 | 38 | 36 | |
| **SPURIOUS RESPONSES** | Channel | | | | | Notes:-<br>None |
| | Interfering Signal | Frequency (Mc/s) | | | | |
| | | Ratio (dB) (1) | | | | |
| **LOCAL OSCILLATOR** | Channel | | 30 | 44 | 64 | Notes:- |
| | Total drift (kc/s) | | - | 60 | - | |
| | Time taken to stabilize (min) (2) | | - | - | - | |
| | P.D. at aerial socket (3) | | 50 | 76 | 84 | |
| **I.F.** | Nominal frequency of vision carrier (Mc/s) | | | | 45·75 | Notes:- No interference from Channel I noticed. |
| **TUNING** | Ease of adjustment (4) | | 4 | Notes:- No reference point is provided for the "channel number" calibrations on the tuning knob. Only one speed of adjustment is provided. | | |
| | Limits of range (Mc/s) (5) | Upper | -0·8 | | | |
| | | Lower | -1·3 | | | |
| **A.G.C.** | Limits of range (dB) (6) | Upper | 22 | Notes:- | | |
| | | Lower | 17 | | | |
| **HUM** | Positional | Noticeable | | V.H.F. PERFORMANCE | Nil | |
| | Amplitude | Imperceptible | | | | |

Additional Notes:-

(a) An I.F. vision carrier of 44·75 Mc/s was used for these measurements.

(b) The interference produced by the N + 10th channel is due to the image sound carrier falling within the I.F. pass-band. The levels quoted are those of the vision carrier, due allowance having been made for the sound/vision carrier power ratio.

## Measurements carried out by Designs Department

| | | | | |
|---|---|---|---|---|
| **SOUND/CHROMINANCE BEAT PATTERN** (7) | | 2 | | |
| **PERMISSIBLE CARRIER INCREASES** | Chrominance sub-carrier (dB) (8) | not measured | | |
| | Sound carrier (dB) (9) | 8 | | |
| **NOISE FACTOR** | Channel | | 42 | |
| | Noise Factor (dB) | | 11 | |
| **MINIMUM INPUT FOR ACCEPTABLE RECEIVER OPERATION** ($\mu$V r.m.s.) (10) | | 290 See Note (c) | | |
| **SELF-GENERATED PATTERNS** (7) | | 2 | | |
| **WAVEFORM DISTORTION** | Measured 2T pulse-to-bar ratio (%) | 130 | | |
| | K-rating of 2T pulse shape (%) | 8 | | |
| **CARRIER AMPLITUDE RATIOS** | Sound relative to vision (dB) (11) | -25 | | |
| | Chrominance relative to vision (dB) (11) | +4 | | |
| | Vision relative to mid-band response (dB) (11) | -6 | | |

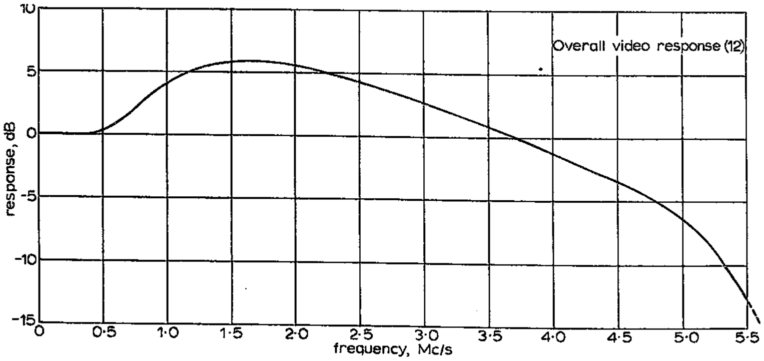
Additional Notes:-

(c) The receiver input impedance is 300 Ω.

(d) The receiver is relatively sensitive.

(e) Trouble may be experienced when operating the receiver near a Channel I transmitter due to the i.f. falling in this band.

(f) Sound quality is poor.



## References

| | |
|---|---|
| Designs Department Test Report No. | 6·292 |
| Research Department Test Report dated | 28/3/63 |

# MONOCHROME RECEIVER NO. 13

## Measurements carried out by Research Department

| | | | | | | |
|---|---|---|---|---|---|---|
| RESPONSE TO CHANNEL N + 10 | Channel (N) | | 24 | 43 | 64 | Notes:- |
| | Ratio (dB) (1) | | -26 | -25 | -35 | |
| | Attenuation of R.F. stages (dB) | | 48 | 47 | 57 | |
| SPURIOUS RESPONSES | Channel | | | | | Notes:-<br>None |
| | Interfering Signal | Frequency (Mc/s) | | | | |
| | | Ratio (dB) (1) | | | | |
| LOCAL OSCILLATOR | Channel | | 27 | 45 | 65 | Notes:- |
| | Total drift (kc/s) | | - | 200 | - | |
| | Time taken to stabilize (min) (2) | | - | 4 | - | |
| | P.D. at aerial socket (3) | | 57 | 49 | 48 | |
| I.F. | Nominal frequency of vision carrier (Mc/s) | | | | 39·25 | Notes:- |
| TUNING | Ease of adjustment (4) | | 3 | Notes:- | | |
| | Limits of range (Mc/s) (5) | Upper | +0·2 | | | |
| | | Lower | -2 | | | |
| A.G.C. | Limits of range (dB) (6) | Upper | 40 | Notes:- | | |
| | | Lower | 20 | | | |
| HUM | Positional | Not measured | | V.H.F. PERFORMANCE | Satisfactory | |
| | Amplitude | Not measured | | | | |

Additional Notes:-

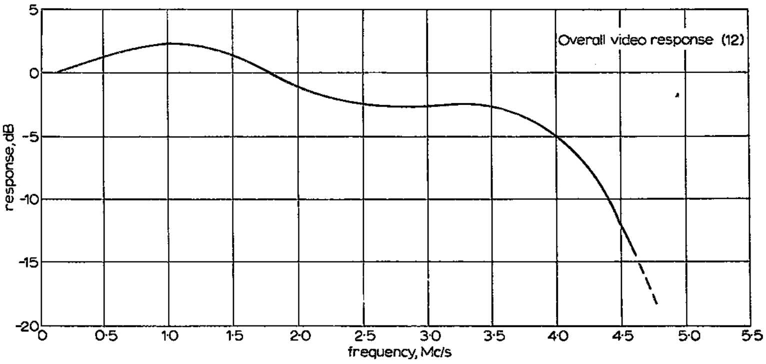
## Measurements carried out by Designs Department

| | | | | |
|---|---|---|---|---|
| SOUND/CHROMINANCE BEAT PATTERN (7) | | 1 | | |
| PERMISSIBLE CARRIER INCREASES | Chrominance sub-carrier (dB) (8) | not measured | | |
| | Sound carrier (dB) (9) | 9 | | |
| NOISE FACTOR | Channel | 21 | 44 | 68 |
| | Noise Factor (dB) | 12 | 11 | 13 |
| MINIMUM INPUT FOR ACCEPTABLE RECEIVER OPERATION ($\mu$V r.m.s.) | | 520 (10) | | |
| SELF-GENERATED PATTERNS (7) | | 3 See Note (b) | | |
| WAVEFORM DISTORTION | Measured 2T pulse-to-bar ratio (%) | 60 | | |
| | K-rating of 2T pulse shape (%) | 10 | | |
| CARRIER AMPLITUDE RATIOS | Sound relative to vision (dB) (11) | -34 | | |
| | Chrominance relative to vision (dB) (11) | -5 | | |
| | Vision relative to mid-band response (dB) (11) | -6 | | |

Additional Notes:-

(a) The tuning control had negligible backlash and was fine enough to enable tuning to be easily carried out. It was, however, a little too fine to tune easily from one end of the scale to the other.

(b) A moving 'hum' bar was visible which contributed to the low rating.



## References

| | |
|---|---|
| Designs Department Test Report No. | 6·282 |
| Research Department Test Report dated | 4/10/62 |

# COLOUR RECEIVER NO. 1 (NTSC)

## Measurements carried out by Research Department

| | | | | | | |
|---|---|---|---|---|---|---|
| **RESPONSE TO CHANNEL N + 10** | Channel (N) | | 25 | 45 | 64 | Notes:- Measurements carried out with I.F. vision carrier frequency of 37·5 Mc/s. See Note (a). |
| | Ratio (dB) (1) | | <-44 | <-44 | <-44 | |
| | Attenuation of R.F. stages (dB) | | 53 | 52 | 46 | |
| **SPURIOUS RESPONSES** | Channel | | | | | Notes:- None |
| | Interfering Signal | Frequency (Mc/s) | | | | |
| | | Ratio (dB) (1) | | | | |
| **LOCAL OSCILLATOR** | Channel | | 25 | 44 | 65 | Notes:- Automatic frequency control (a.f.c.) was not provided when these measurements were taken, but has since been fitted. |
| | Total drift (kc/s) | | - | 1460 | - | |
| | Time taken to stablize (min) (2) | | - | 32 | - | |
| | P.D. at aerial socket (3) | | 55 | 43 | 56 | |
| **I.F.** | Nominal frequency of vision carrier (Mc/s) | | | | 39·5 | Notes:- See Note (a) |
| **TUNING** | Ease of adjustment (4) | | 5 | | | Notes:- The ease of adjustment was not improved by the provision of a.f.c. No tuning indicator is provided. See Note (a) |
| | Limits of range (Mc/s) (5) | Upper | -1·5 | | | |
| | | Lower | -2·5 | | | |
| **A.G.C.** | Limits of range (dB) (6) | Upper | 36 | | | Notes:- |
| | | Lower | 17 | | | |
| **HUM** | Positional | Imperceptible | | V.H.F. PERFORMANCE | Nil | |
| | Amplitude | Perceptible | | | | |

Additional Notes:-

(a) The nominal frequency of the I.F. vision carrier has been assumed to be the same as that used in monochrome receivers made by this manufacturer. Satisfactory reception could, however, only be obtained when the I.F. vision carrier lay in the frequency range of 37 - 38 Mc/s.

## Measurements carried out by Designs Department

| | | | | | |
|---|---|---|---|---|---|
| **SOUND/CHROMINANCE BEAT PATTERN** (7) | | 1 | | | |
| **PERMISSIBLE CARRIER INCREASES** | Chrominance sub-carrier (dB) (8) | not measured | | | |
| | Sound carrier (dB) (9) | >10 | | | |
| **NOISE FACTOR** | Channel | | | | |
| | Noise Factor (dB) | not | measur | ed | |
| **MINIMUM INPUT FOR ACCEPTABLE RECEIVER OPERATION ($\mu$V r.m.s.)** | | 770 (10) | | | |
| **SELF-GENERATED PATTERNS** (7) | | 1 | | | |
| **WAVEFORM DISTORTION** | Measured 2T pulse-to-bar ratio (%) | 75 See Note (e) | | | |
| | K-rating of 2T pulse shape (%) | 10 See Note (e) | | | |
| **CARRIER AMPLITUDE RATIOS** | Sound relative to vision (dB) (11) | -45 | | | |
| | Chrominance relative to vision (dB) (11) | +3 | | | |
| | Vision relative to mid-band response (dB) (11) | -6 | | | |

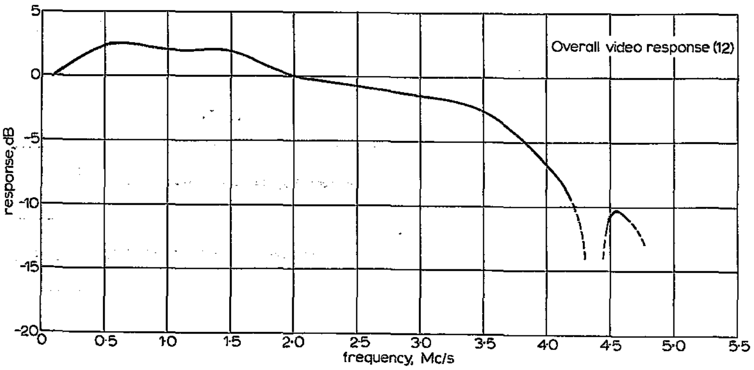
Additional Notes:-

(b) The tuning range over which good colour pictures and reasonable sound can be obtained is narrow.

(c) Access to the underside of the chassis is restricted.

(d) The Cabinet legs are unsteady and this makes the receiver mechanically unstable.

(e) The waveform distortion is considered to be excessive.



## References

| | |
|---|---|
| Designs Department Test Report No. | 6·287 |
| Research Department Test Report dated | 28/3/63 |

# COLOUR RECEIVER NO. 1A (NTSC)

## Measurements carried out by Research Department

| | | | | | | |
|---|---|---|---|---|---|---|
| RESPONSE TO CHANNEL N + 10 | Channel (N) | | 24 | 45 | 60 | Notes:- See Note (a) |
| | Ratio (dB) (1) | | -6 | -5 | -10 | |
| | Attenuation of R.F. stages (dB) | | 48 | 47 | 52 | |
| SPURIOUS RESPONSES | Channel | | | | | Notes:- None |
| | Interfering Signal | Frequency (Mc/s) | | | | |
| | | Ratio (dB) (1) | | | | |
| LOCAL OSCILLATOR | Channel | | 24 | 45 | 57 | Notes:- |
| | Total drift (kc/s) | | - | 160 | - | |
| | Time taken to stabilize (min) (2) | | - | 1½ | - | |
| | P.D. at aerial socket (3) | | 63 | 52 | 51 | |
| I.F. | Nominal frequency of vision carrier (Mc/s) | | 39·5 | | | Notes:- |
| TUNING | Ease of adjustment (4) | | 3 | | | Notes:- See Note (b) |
| | Limits of range (Mc/s) (5) | Upper | +0·05 | | | |
| | | Lower | -0·11 | | | |
| A.G.C. | Limits of range (dB) (6) | Upper | 33 | | | Notes:- See Notes (a) and (c) |
| | | Lower | 30 | | | |
| HUM | Positional | Very perceptible | V.H.F. PERFORMANCE | Nil | | |
| | Amplitude | Perceptible | | | | |

Additional Notes:-

(a) Measurements made with "standard" signal of 4 mV open-circuit e.m.f. to avoid noisy display.

(b) An effective A.F.C. circuit is provided which can be switched off when tuning.

(c) Lower A.G.C. limit determined by noise on display.

(d) This receiver was obtained from the manufacturer as a replacement for one having inferior performance. (See Colour Receiver No. 1).

## Measurements carried out by Designs Department

| | | | | |
|---|---|---|---|---|
| SOUND/CHROMINANCE BEAT PATTERN (7) | | | | |
| PERMISSIBLE CARRIER INCREASES | Chrominance sub-carrier (dB) (8) | | | |
| | Sound carrier (dB) (9) | | | |
| NOISE FACTOR | Channel | | | |
| | Noise Factor (dB) | | | |
| MINIMUM INPUT FOR ACCEPTABLE RECEIVER OPERATION ($\mu$V r.m.s.) (10) | | | | |
| SELF-GENERATED PATTERNS (7) | | | | |
| WAVEFORM DISTORTION | Measured 2T pulse-to-bar ratio (%) | | | |
| | K-rating of 2T pulse shape (%) | | | |
| CARRIER AMPLITUDE RATIOS | Sound relative to vision (dB) (11) | | | |
| | Chrominance relative to vision (dB) (11) | | | |
| | Vision relative to mid-band response (dB) (11) | | | |

Additional Notes:-

(e) No measurements were made on this receiver by Designs Department.

## References

| | |
|---|---|
| Designs Department Test Report No. | - |
| Research Department Test Report dated | 29/8/63 |

# COLOUR RECEIVER NO. 2 (NTSC)

## Measurements carried out by Research Department

| | | | | | | |
|---|---|---|---|---|---|---|
| RESPONSE TO CHANNEL N + 10 | Channel (N) | | 25 | 45 | 64 | Notes:- Measurements carried out with I.F. vision carrier frequency of 39·34 Mc/s. |
| | Ratio (dB) (1) | | -27 | -37 | -40 | |
| | Attenuation of R.F. stages (dB) | | 42 | 52 | 55 | |
| SPURIOUS RESPONSES | Channel | | | | | Notes:- None |
| | Interfering Signal | Frequency (Mc/s) | | | | |
| | | Ratio (dB) (1) | | | | |
| LOCAL OSCILLATOR | Channel | | 25 | 44 | 65 | Notes:- Automatic frequency control (a.f.c.) is provided. See Note (a). |
| | Total drift (kc/s) | | - | <16 | - | |
| | Time taken to stabilize (min) (2) | | - | - | - | |
| | P.D. at aerial socket (3) | | 54 | 43 | 55 | |
| I.F. | Nominal frequency of vision carrier (Mc/s) | | | | 39·5 | Notes:- See Note (b) |
| TUNING | Ease of adjustment (4) | | 1 | | | Notes:- The provision of a.f.c. and a 'magic eye' tuning indicator makes tuning very simple. |
| | Limits of range (Mc/s) (5) | Upper | -0·15 | | | |
| | | Lower | -0·18 | | | |
| A.G.C. | Limits of range (dB) (6) | Upper | 28 | | | Notes:- |
| | | Lower | 22 | | | |
| HUM | Positional | Noticeable | | | V.H.F. PERFORMANCE | Nil |
| | Amplitude | Noticeable | | | | |

Additional Notes:-

(a) Temperature drift of the contrast and hue circuits occurs for up to ½ hour after switching on.

(b) The nominal frequency of the I.F. vision carrier has been assumed to be the same as that used in monochrome receivers made by this manufacturer.

## Measurements carried out by Designs Department

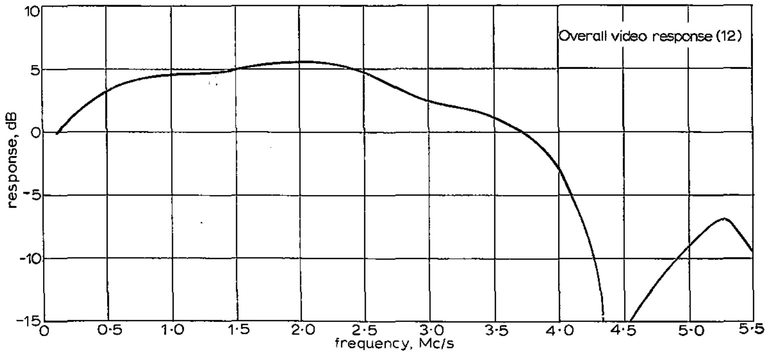
| | | | | |
|---|---|---|---|---|
| SOUND/CHROMINANCE BEAT PATTERN (7) | | 1 | | |
| PERMISSIBLE CARRIER INCREASES | Chrominance sub-carrier (dB) (8) | not measured | | |
| | Sound carrier (dB) (9) | >10 | | |
| NOISE FACTOR | Channel | 25 | 40 | 65 |
| | Noise Factor (dB) | 15·2 | 14·4 | 13·5 |
| MINIMUM INPUT FOR ACCEPTABLE RECEIVER OPERATION ($\mu$V r.m.s.) | | 340 (10) | | |
| SELF-GENERATED PATTERNS (7) | | 3. See Note (c) | | |
| WAVEFORM DISTORTION | Measured 2T pulse-to-bar ratio (%) | 110 | | |
| | K-rating of 2T pulse shape (%) | 6. See Note (d) | | |
| CARRIER AMPLITUDE RATIOS | Sound relative to vision (dB) (11) | -51 | | |
| | Chrominance relative to vision (dB) (11) | +6 | | |
| | Vision relative to mid-band response (dB) (11) | -6 | | |

Additional Notes:-

(c) An amplitude hum bar is visible and is responsible for the low rating in Section 1.5.

(d) The 2T pulse K-rating of 6% is considered to be rather high for a laboratory designed receiver.

(e) Provision of an automatic frequency control makes tuning simple.



## References

| | |
|---|---|
| Designs Department Test Report No. | 6·286 |
| Research Department Test Report dated | 28/3/63 |

# COLOUR RECEIVER NO. 3 (NTSC)

## Measurements carried out by Research Department

| | | | | | | |
|---|---|---|---|---|---|---|
| RESPONSE TO CHANNEL N + 10 | Channel (N) | | 25 | 45 | 64 | Notes:- Measured with an I.F. vision carrier frequency of 39·0 Mc/s. |
| | Ratio (dB) (1) | | -27 | -36 | -36 | |
| | Attenuation of R.F. stages (dB) | | 38 | 47 | 47 | |
| SPURIOUS RESPONSES | Channel | | | | | Notes:- None |
| | Inter-fering Signal | Frequency (Mc/s) | | | | |
| | | Ratio (dB) (1) | | | | |
| LOCAL OSCIL-LATOR | Channel | | 25 | 44 | 65 | Notes:- See Notes (a) and (b) |
| | Total drift (kc/s) | | - | 180 | - | |
| | Time taken to stabilize (min) (2) | | - | 1 | - | |
| | P.D. at aerial socket (3) | | 76 | 51 | 82 | |
| I.F. | Nominal frequency of vision carrier (Mc/s) | | | | 39·5 | Notes:- See Note (c) |
| TUNING | Ease of adjustment (4) | | 3 | | | Notes:- No reference point is provided for the "channel number" calibrations on the tuning knob. The tuning mechanism has good mechanical performance. |
| | Limits of range (Mc/s) (5) | Upper | -0·1 | | | |
| | | Lower | -1·2 | | | |
| A.G.C. | Limits of range (dB) (6) | Upper | 28 | | | Notes:- |
| | | Lower | 22 | | | |
| HUM | Positional | Perceptible | | V.H.F. PERFORMANCE | Nil | |
| | Amplitude | Imperceptible | | | | |

Additional Notes:-

(a) The local oscillator circuit is microphonic and vibrations from the loudspeaker give rise to frequency-modulation of the I.F. vision carrier. During loud sound passages this effect is sufficient to produce "sound-on-vision" interference effects.

(b) Drift of the hue circuits occurs for at least 1 hour after switching on.

(c) The nominal frequency of the I.F. vision carrier has been modified from the American standard of 45·75 Mc/s by the manufacturers to conform to British standards.

## Measurements carried out by Designs Department

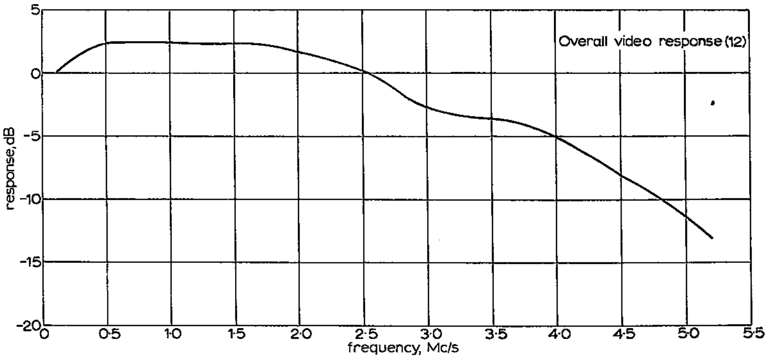
| | | | |
|---|---|---|---|
| SOUND/CHROMINANCE BEAT PATTERN (7) | | 1 | |
| PERMISSIBLE CARRIER INCREASES | Chrominance sub-carrier (dB) (8) | not measured | |
| | Sound carrier (dB) (9) | >10 | |
| NOISE FACTOR | Channel | 43 | |
| | Noise Factor (dB) | 20 | |
| MINIMUM INPUT FOR ACCEPTABLE RECEIVER OPERATION ($\mu$V r.m.s.) | | 2600 | See Notes (10) (d) and (e) |
| SELF-GENERATED PATTERNS (7) | | 1. See Note (f) | |
| WAVEFORM DISTORTION | Measured 2T pulse-to-bar ratio (%) | 95 | |
| | K-rating of 2T pulse shape (%) | 3 | |
| CARRIER AMPLITUDE RATIOS | Sound relative to vision (dB) (11) | -36 | |
| | Chrominance relative to vision (dB) (11) | +3 | |
| | Vision relative to mid-band response (dB) (11) | -4 | |

Additional Notes:-

(d) The receiver input impedance is 300 Ω.

(e) The minimum usable input is relatively high.

(f) A beat pattern is noticeable at some tuning positions with an input of less than 4 mV.



## References

| | |
|---|---|
| Designs Department Test Report No. | 6·288 |
| Research Department Test Report dated | 1/4/63 |

# COLOUR RECEIVER NO. 4 (SECAM)

## Measurements carried out by Research Department

| | | | | | | |
|---|---|---|---|---|---|---|
| RESPONSE TO CHANNEL N + 10 | Channel (N) | | 21 | 33 | 58 | Notes:- See Notes (a) and (b) |
| | Ratio (dB) (1) | | -36 | -37 | -37 | |
| | Attenuation of R.F. stages (dB) | | 59 | 60 | 60 | |
| SPURIOUS RESPONSES | Channel | | | | | Notes:- See Notes (a) and (b) |
| | Inter-fering Signal | Frequency (Mc/s) | | | | |
| | | Ratio (dB) (1) | | | | |
| LOCAL OSCIL-LATOR | Channel | | 21 | 33 | 58 | Notes:- |
| | Total drift (kc/s) | | - | 150 | - | |
| | Time taken to stabilize (min) (2) | | - | 0 | - | |
| | P.D. at aerial socket (3) | | 51 | 41 | 49 | |
| I.F. | Nominal frequency of vision carrier (Mc/s) | | | | 39·4 | Notes:- See Note (c) |
| TUNING | Ease of adjustment (4) | | 3 | Notes:- No automatic frequency control circuit or tuning indicator is provided. | | |
| | Limits of range (Mc/s) (5) | Upper | -0·2 | | | |
| | | Lower | -1·4 | | | |
| A.G.C. | Limits of range (dB) (6) | Upper | >40 | Notes:- Lower A.G.C. limit set by receiver noise. See Note (a). | | |
| | | Lower | 14 | | | |
| HUM | Positional | Perceptible | | V.H.F. PERFORMANCE | Not suitable for 405-line operation. | |
| | Amplitude | Imperceptible | | | | |

Additional Notes:-

(a) All measurements were made with a standard wanted signal of 4 mV e.m.f. to avoid a noisy displayed picture.

(b) These measurements were made with an I.F. vision carrier frequency of 39·0 Mc/s.

(c) No data is available for this type of receiver, and the frequency normally used by this manufacturer has therefore been taken as applicable to this case.

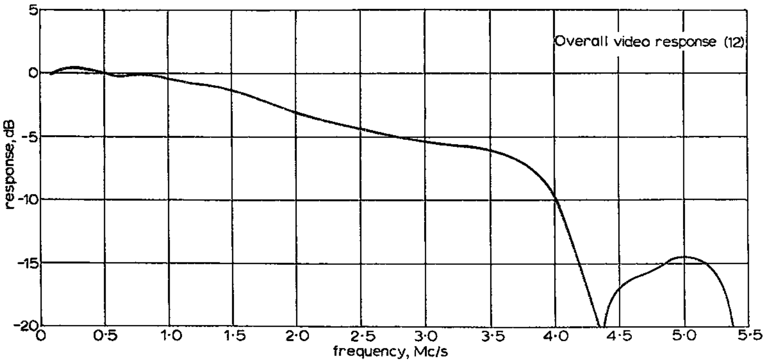
## Measurements carried out by Designs Department

| | | | | |
|---|---|---|---|---|
| SOUND/CHROMINANCE BEAT PATTERN (7) | | 2 | | |
| PERMISSIBLE CARRIER INCREASES | Chrominance sub-carrier (dB) (8) | not measured | | |
| | Sound carrier (dB) (9) | >10 | | |
| NOISE FACTOR | Channel | 34 | 45 | |
| | Noise Factor (dB) | 15·5 | 15 | |
| MINIMUM INPUT FOR ACCEPTABLE RECEIVER OPERATION (µV r.m.s.) | | 760 (10) | | |
| SELF-GENERATED PATTERNS (7) | | 3. See Note (e) | | |
| WAVEFORM DISTORTION | Measured 2T pulse-to-bar ratio (%) | 64 | | |
| | K-rating of 2T pulse shape (%) | 2 | | |
| CARRIER AMPLITUDE RATIOS | Sound relative to vision (dB) (11) | -50 | | |
| | Chrominance relative to vision (dB) (11) | +7·2 | | |
| | Vision relative to mid-band response (dB) (11) | -5 | | |

Additional Notes:-

(d) Receiver difficult to tune due to considerable backlash and absence of any form of tuning indicator.

(e) Rating of self-generated pattern mainly due to a horizontal stationary bright line near the bottom of the picture.



## References

| | |
|---|---|
| Designs Department Test Report No. | 8·37 |
| Research Department Test Report dated | 10/10/63 |

# COLOUR RECEIVER NO. 5 (NTSC)

## Measurements carried out by Research Department

| | | | | | |
|---|---|---|---|---|---|
| RESPONSE TO CHANNEL N + 10 | Channel (N) | 24 | 45 | 60 | Notes:- See Notes (a) and (b) |
| | Ratio (dB) (1) | -19 | -16 | -18 | |
| | Attenuation of R.F. stages (dB) | 63 | 60 | 62 | |
| SPURIOUS RESPONSES | Channel | | | | Notes:- None |
| | Interfering Signal — Frequency (Mc/s) | | | | |
| | Interfering Signal — Ratio (dB) (1) | | | | |
| LOCAL OSCILLATOR | Channel | 24 | 45 | 57 | Notes:- |
| | Total drift (kc/s) | - | 1080 | - | |
| | Time taken to stabilize (min) (2) | - | 8 | - | |
| | P.D. at aerial socket (3) | 42 | 42 | 41 | |
| I.F. | Nominal frequency of vision carrier (Mc/s) | 39·4 | | | Notes:- |
| TUNING | Ease of adjustment (4) | 4 | | | Notes:- Errors of up to four channel numbers on dial. See Notes (a) and (c). |
| | Limits of range (Mc/s) (5) — Upper | -0·1 | | | |
| | Limits of range (Mc/s) (5) — Lower | -0·6 | | | |
| A.G.C. | Limits of range (dB) (6) — Upper | 3 | | | Notes:- Very poor A.G.C. See Note (b). |
| | Limits of range (dB) (6) — Lower | 3 | | | |
| HUM | Positional | Perceptible | V.H.F. PERFORMANCE | Not suitable for 405-line operation. | |
| | Amplitude | Imperceptible | | | |

Additional Notes:-

(a) Measurement of response to Channel N + 10 made with vision carrier I.F. of 39·0 Mc/s.

(b) Measurements made with "standard" signal of 4 mV open-circuit e.m.f. to avoid noisy display.

(c) No A.F.C. circuit or tuning indicator is provided.

## Measurements carried out by Designs Department

| | | | | |
|---|---|---|---|---|
| SOUND/CHROMINANCE BEAT PATTERN (7) | | 1 | | |
| PERMISSIBLE CARRIER INCREASES | Chrominance sub-carrier (dB) (8) | not measured | | |
| | Sound carrier (dB) (9) | >10 | | |
| NOISE FACTOR | Channel | 34 | 45 | See Note (f) |
| | Noise Factor (dB) | 19·0 | 19·5 | |
| MINIMUM INPUT FOR ACCEPTABLE RECEIVER OPERATION ($\mu$V r.m.s.) (10) | | 860 | | |
| SELF-GENERATED PATTERNS (7) | | 1 See Note (g) | | |
| WAVEFORM DISTORTION | Measured 2T pulse-to-bar ratio (%) | 80 See Note (h) | | |
| | K-rating of 2T pulse shape (%) | 6 See Note (h) | | |
| CARRIER AMPLITUDE RATIOS | Sound relative to vision (dB) (11) | -42 | | |
| | Chrominance relative to vision (dB) (11) | +2 | | |
| | Vision relative to mid-band response (dB) (11) | -5·2 | | |

Additional Notes:-

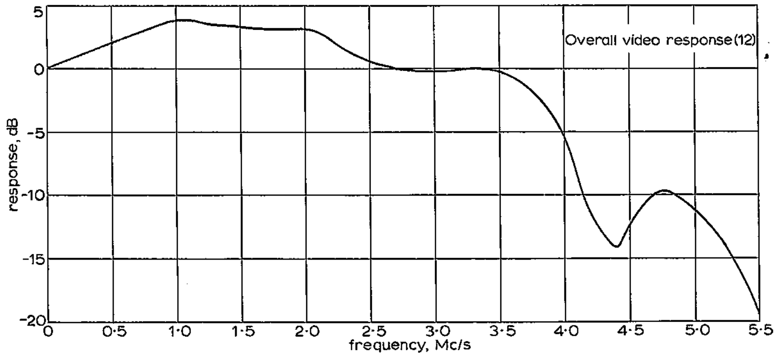
(d) Receiver difficult to tune due to considerable backlash and absence of any form of tuning indicator.

(e) AGC rather poor, necessitating continual adjustment of contrast control while tuning.

(f) Noise factor especially poor.

(g) HT smoothing seems to be inadequate: a moving hum bar is visible on certain pictures.

(h) The waveform distortion is considered to be rather high.



## References

| | |
|---|---|
| Designs Department Test Report No. | 8·39 |
| Research Department Test Report dated | 29/8/63 |

# COLOUR RECEIVER NO. 6 (SECAM)

## Measurements carried out by Research Department

| | | | | | | |
|---|---|---|---|---|---|---|
| RESPONSE TO CHANNEL N + 10 | Channel (N) | | 32 | 39 | 46 | Notes:- See notes (b), (c) and (d) |
| | Ratio (dB) (1) | | <-40 | <-40 | <-40 | |
| | Attenuation of R.F. stages (dB) | | 65 | 64 | 56 | |
| SPURIOUS RESPONSES | Channel | | 32 | 39 | 46 | Notes:- See notes (b), (c) and (d) |
| | Inter-fering Signal | Frequency (Mc/s) | 592 | 653 | 716 | |
| | | Ratio (dB) (1) | -18 | -12 | -21 | |
| LOCAL OSCIL-LATOR | Channel | | 32 | 39 | 46 | Notes:- |
| | Total drift (kc/s) | | 200 | - | - | These stability measurements taken on Channel 33. |
| | Time taken to stabilize (min) (2) | | 3 | - | - | |
| | P.D. at aerial socket (3) | | 50 | 49 | 45 | |
| I.F. | Nominal frequency of vision carrier (Mc/s) | | 38·5 | | | Notes:- See note (e) |
| TUNING | Ease of adjustment (4) | | 3 | | | Notes:- A tuning indicator is provided. This gives a good indication of the correct tuning point. See note (f). |
| | Limits of range (Mc/s) (5) | Upper | +0·13 | | | |
| | | Lower | -0·17 | | | |
| A.G.C. | Limits of range (dB) (6) | Upper | 30 | | | Notes:- See Note (b) |
| | | Lower | 20 | | | |
| HUM | Positional | Just perceptible | | | V.H.F. PERFORMANCE | Nil |
| | Amplitude | Just perceptible | | | | |

Additional Notes:-

(a) Converted to SECAM operation by the manufacturers.

(b) All measurements were made with a standard wanted signal of 4 mV e.m.f. to avoid a noisy displayed picture.

(c) These measurements were made with an I.F. vision carrier frequency of 38·5 Mc/s.

(d) Tuning range limited to Channels 32 - 46.

(e) The I.F. vision carrier frequency corresponding to the correct setting of the tuning indicator has been taken as the nominal value.

(f) The horizontal resolution of the displayed picture was very poor, even when the receiver was correctly tuned.

## Measurements carried out by Designs Department

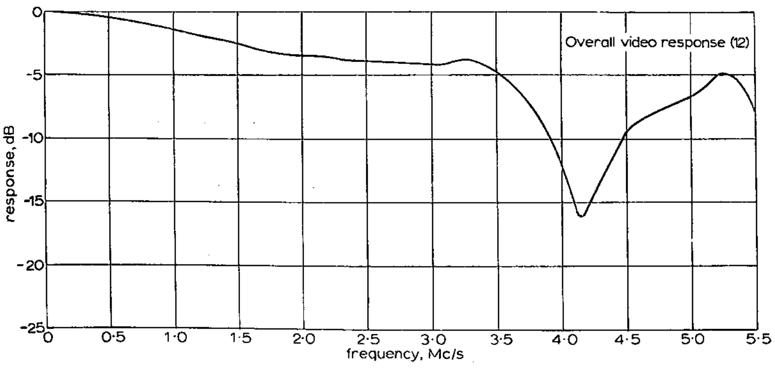
| | | | | |
|---|---|---|---|---|
| SOUND/CHROMINANCE BEAT PATTERN (7) | | 2 | | |
| PERMISSIBLE CARRIER INCREASES | Chrominance sub-carrier (dB) (8) | not measured | | |
| | Sound carrier (dB) (9) | >10 | | |
| NOISE FACTOR | Channel | 34 | 44 | |
| | Noise Factor (dB) | 14·5 | 13·5 | |
| MINIMUM INPUT FOR ACCEPTABLE RECEIVER OPERATION ($\mu$V r.m.s.) | | 1500 (10) | | |
| SELF-GENERATED PATTERNS (7) | | 2 | | |
| WAVEFORM DISTORTION | Measured 2T pulse-to-bar ratio (%) | 72 See Note (i) | | |
| | K-rating of 2T pulse shape (%) | 7 See Note (i) | | |
| CARRIER AMPLITUDE RATIOS | Sound relative to vision (dB) (11) | -35·5 | | |
| | Chrominance relative to vision (dB) (11) | 0 | | |
| | Vision relative to mid-band response (dB) (11) | -2·5 | | |

Additional Notes:-

(g) The single speed of adjustment of the tuning control is too coarse for making accurate adjustments, but too fine for easy tuning between channels.

(h) The colour pictures were rather noisy even at the highest signal strength used for the tests. This was thought to be due to poor decoder design.

(i) The waveform distortion is considered to be rather high.



## References

| | |
|---|---|
| Designs Department Test Report No. | 8·38 |
| Research Department Test Report dated | 8/11/63 |

# COLOUR RECEIVER NO. 7 (PAL)

## Measurements carried out by Research Department

| | | | | | | |
|---|---|---|---|---|---|---|
| RESPONSE TO CHANNEL N + 10 | Channel (N) | | 30 | 42 | 46 | Notes:- |
| | Ratio (dB) (1) | | <-40 | <-40 | <-40 | See notes (b), (c) and (d) |
| | Attenuation of R.F. stages (dB) | | 62 | 50 | 54 | |
| SPURIOUS RESPONSES | Channel | | 30 | 42 | 46 | Notes:- |
| | Inter-fering Signal | Frequency (Mc/s) | 563 | 659 | 691 | See notes (b), (c) and (d) |
| | | Ratio (dB) (1) | -22 | -14 | -15 | |
| LOCAL OSCIL-LATOR | Channel | | 30 | 42 | 46 | Notes:- |
| | Total drift (kc/s) | | 62 | - | - | These stability measurements taken on Channel 33. |
| | Time taken to stabilize (min) (2) | | 0 | - | - | |
| | P.D. at aerial socket (3) | | 56 | 56 | 54 | |
| I.F. | Nominal frequency of vision carrier (Mc/s) | | | | 38·46 | Notes:- See note (e) |
| TUNING | Ease of adjustment (4) | | 2 | Notes:- An automatic frequency control circuit and a tuning indicator are provided. The tuning indicator gives a very precise indication of the correct tuning point. | | |
| | Limits of (5) range (Mc/s) | Upper | +0·05 | | | |
| | | Lower | -0·05 | | | |
| A.G.C. | Limits of (6) range (dB) | Upper | >41 | Notes:- See note (b). | | |
| | | Lower | 3 | | | |
| HUM | Positional | Just perceptible | | V.H.F. PERFORMANCE | Nil | |
| | Amplitude | Imperceptible | | | | |

Additional Notes:-

(a) An NTSC receiver modified to the PAL system by BBC Designs Department.

(b) All measurements were made with a standard wanted signal of 4 mV e.m.f. to avoid a noisy displayed picture.

(c) These measurements were made with an I.F. vision carrier frequency of 38·46 Mc/s.

(d) Tuning range limited to Channels 30 - 46.

(e) The I.F. vision carrier frequency corresponding to the correct setting of the tuning indicator has been taken as the nominal value.

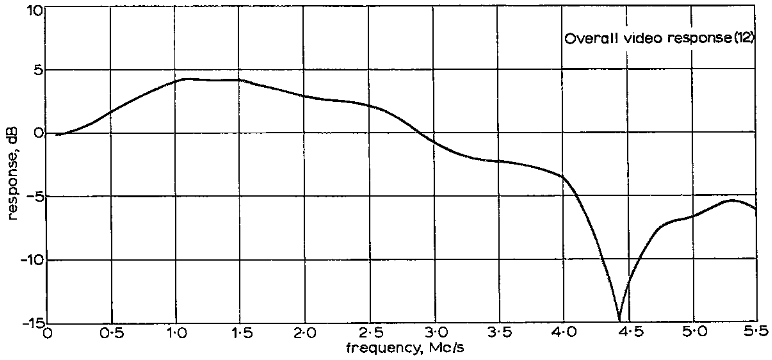
## Measurements carried out by Designs Department

| | | | | |
|---|---|---|---|---|
| SOUND/CHROMINANCE BEAT PATTERN (7) | | 2 | | |
| PERMISSIBLE CARRIER INCREASES | Chrominance sub-carrier (dB) (8) | not measured | | |
| | Sound carrier (dB) (9) | 6 | | |
| NOISE FACTOR | Channel | 34 | 45 | |
| | Noise Factor (dB) | 15 | 18 | |
| MINIMUM INPUT FOR ACCEPTABLE RECEIVER OPERATION (μV r.m.s.) | | 650 (10) | | |
| SELF-GENERATED PATTERNS (7) | | 2 | | |
| WAVEFORM DISTORTION | Measured 2T pulse-to-bar ratio (%) | 78 See Note (g) | | |
| | K-rating of 2T pulse shape (%) | 7 See Note (g) | | |
| CARRIER AMPLITUDE RATIOS | Sound relative to vision (dB) (11) | -42 | | |
| | Chrominance relative to vision (dB) (11) | -6·3 | | |
| | Vision relative to mid-band response (dB) (11) | +3 | | |

Additional Notes:-

(f) If modulation is temporarily removed from the carrier, the A.G.C. tends to lock out so that a picture can only be obtained by off-tuning and re-tuning the receiver.

(g) The waveform distortion is considered to be rather high.



## References

| | |
|---|---|
| Designs Department Test Report No. | 8·36 |
| Research Department Test Report dated | 9/10/63 |

# COLOUR RECEIVER NO. 8 (NTSC)

## Measurements carried out by Research Department

| | | | | | | |
|---|---|---|---|---|---|---|
| RESPONSE TO CHANNEL N + 10 | Channel (N) | | 30 | 42 | 46 | Notes:- |
| | Ratio (dB) (1) | | <-40 | <-40 | <-40 | See Notes (a), (b) and (c) |
| | Attenuation of R.F. stages (dB) | | 66 | 52 | 58 | |
| SPURIOUS RESPONSES | Channel | | 30 | 42 | 46 | Notes:- |
| | Interfering Signal | Frequency (Mc/s) | 563 | 659 | 691 | See Notes (a), (b) and (c) |
| | | Ratio (dB) (1) | -21 | -21 | -20 | |
| LOCAL OSCILLATOR | Channel | | 30 | 42 | 46 | Notes:- |
| | Total drift (kc/s) | | 70 | - | - | These stability measurements taken on Channel 33. |
| | Time taken to stabilize (min) (2) | | 0 | - | - | |
| | P.D. at aerial socket (3) | | 63 | 59 | 57 | |
| I.F. | Nominal frequency of vision carrier (Mc/s) | | | | 38·38 | Notes:- See Note (d) |
| TUNING | Ease of adjustment (4) | | 3 | Notes:- An automatic frequency control circuit and a tuning indicator are provided. The tuning indicator, however, gives a rather ambiguous indication of the correct tuning point. | | |
| | Limits of range (Mc/s) (5) | Upper | +0·15 | | | |
| | | Lower | -0·34 | | | |
| A.G.C. | Limits of range (dB) (6) | Upper | >41 | Notes:- The lower a.g.c. limit is set by receiver noise. See Note (a). | | |
| | | Lower | 9 | | | |
| HUM | Positional | Just Perceptible | | V.H.F. PERFORMANCE | Nil | |
| | Amplitude | Just Perceptible | | | | |

Additional Notes:-

(a) All measurements were made with a standard wanted signal of 4 mV e.m.f. to avoid a noisy displayed picture.

(b) These measurements were made with an I.F. vision carrier frequency of 38 Mc/s.

(c) Tuning range limited to Channels 30 - 46.

(d) The I.F. vision carrier corresponding to the correct setting of the tuning indicator has been taken as the nominal value.

## Measurements carried out by Designs Department

| | | | | |
|---|---|---|---|---|
| SOUND/CHROMINANCE BEAT PATTERN (7) | | | | |
| PERMISSIBLE CARRIER INCREASES | Chrominance sub-carrier (dB) (8) | | | |
| | Sound carrier (dB) (9) | | | |
| NOISE FACTOR | Channel | | | |
| | Noise Factor (dB) | | | |
| MINIMUM INPUT FOR ACCEPTABLE RECEIVER OPERATION ($\mu$V r.m.s.) (10) | | | | |
| SELF-GENERATED PATTERNS (7) | | | | |
| WAVEFORM DISTORTION | Measured 2T pulse-to-bar ratio (%) | | | |
| | K-rating of 2T pulse shape (%) | | | |
| CARRIER AMPLITUDE RATIOS | Sound relative to vision (dB) (11) | | | |
| | Chrominance relative to vision (dB) (11) | | | |
| | Vision relative to mid-band response (dB) (11) | | | |

Additional Notes:-

(e) No measurements were made on this receiver by Designs Department.

## References

| | |
|---|---|
| Designs Department Test Report No. | |
| Research Department Test Report dated | 9/10/63 |

## *APPENDIX III*

### *Vision and Sound Carrier Frequencies in Bands IV and V*

The vision-carrier frequency ($F_v$) and sound-carrier frequency ($F_s$) of Channel N in Bands IV and V are given by:

$$F_v = 303{\cdot}25 + 8N \quad \text{Mc/s}$$

$$F_s = 309{\cdot}25 + 8N \quad \text{Mc/s}$$

Band IV comprises Channels 21 - 34 inclusive and

Band V comprises Channels 39 - 68 inclusive:

Channels 35 - 38 are not available for television broadcasting.

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